THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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1906 Edition

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BRIBERY OR BLACKMAIL?

THIS is a subject which every man would fain avoid. It is a many-headed monster, taking all manner of shapes, and growing of late years to alarming proportions. It has been tackled in recent times by Sir Edward Fry, by the late Lord Russell, and by many other "public-minded" men, including the Ex-Lord Chancellor and his successor, who are now seen working together to pass into law "An Act for the better Prevention of Corruption."

No one can study history, however superficially, from that of Ancient Rome, to that of Modern Russia, without seeing in corruption the chief cause of the downfall of great States. Of all forms of avarice, bribery is surely the most ruinous to the body politic, and to the soul of the individual. It is a difficult subject, but one which we have never attempted to shirk.

At first sight it may be thought that a bribe necessarily means an inducement to do something wrong, or to betray a trust. This is by no means always the case; in fact, it is really infrequent. Often the bribe is taken as an inducement to do the right thing, or to select the right article.

From an engineer's point of view this is important. The "man in the street" might say, when he heard of corruption in regard to a contract, that the undertaking was sure to be a failure. Not so; for it may often be the case that both parties to the transaction are all the more anxious that everything should work well and give no cause for comment or investigation.

Nor is the giving of illicit commissions entirely confined to the second-class firms and the receiving of them to the inferior order of engineers and agents. The corrupt buyer, unless he be a clumsy fool, whose actions will soon become of no importance, first eliminates unsuitable tenderers by asking only reliable firms to quote; or, if compelled to advertise, he eliminates them after tenders are received. Then he picks from among the best offers the one which will yield his bribe. For this reason many works tarred all over with the brush of corruption are mechanical and commercial successes. However, taking each job by itself, it is not evident that the principals have actually been robbed.

Perhaps the lowest amongst the best offers has been accepted. Wherein, then, lies the wrong? Morally—no clean-minded man can doubt that the wrong is there, leaving its dirty stain on all concerned. But commercially—and we must all think commercially whether we would or not—"Where," says the able engineer, who has made a success of the undertaking, and "made a bit for himself" at the same time—"Where is the wrong?"

It lies, of course, in the general injury to trade. The bribe must be paid and recovered somehow; if not out of that contract, out of the next. A big bill of extras may pass an eye blinded with a piece of gold. Consideration, impossible to value, must be given in return, by the engineer who has sold his independence.

Nothing is so infectious as dishonest conduct in business. It spreads from the chief to the subordinate like a disease, and destroys that confidence which is the true heart and soul of business.

We are not concerned with such things as the "tip" to the waiter and the porter; they are now British institutions, and wages are regulated accordingly. Nor need we discuss those cunning wrappers on soap and other domestic necessities, carrying a premium to the cook and the housemaid for wasting as much as possible.

We have said our say about the little presents that circulate about Christmas time—mere compliments, so to speak—which are, after all, definitely separated from the passing of cash.

A case has been cited of an eminent consulting engineer (real or imaginary, we know not) who had a villa on the Continent, to which he invited directors of companies and others who had works to carry out. It is clear that it is quite hopeless to devise a net to catch such a culprit as this; and he may well be left to public opinion. The great defect in the law, as it stands, is not that it lacks penalties for those who are found out, but that it fails to discover the wrongdoers. In this respect the new Bill offers no remedy.

We do not call to mind any case in which corruption was proven in which due punishment of both parties did not follow. But in this matter, above all others, the law really means, "Thou shalt not be found out."

Is it generally known that, under the existing law, a firm or authority whose agent is known to have taken secret commissions can recover from the firm paying such commissions the full amount of them, and can, besides, institute criminal proceedings against both parties?

Moreover, in municipal matters the law has for years been specialised, and carries into effect all the drastic provisions which it is now proposed, under the new Bill, to make generally applicable to public and private business. And yet it is notorious that the agents and members of municipal authorities have among their ranks at least as large a proportion of "black sheep" as those who come under the common law. The fact is that the law is drastic enough, but it is practically inoperative.

We remember seeing a suggestion, some time ago, that only one of the parties to a corrupt act should be punishable, thus introducing the danger of disclosure by the other party. We believe the failure of the present law is due to the fact that the only persons privy to such transactions, namely, the giver and the receiver, are both equally punishable, and both are therefore practically compelled by the law itself to keep silence.

Which, then, should be released from the terrors of the law? It is our belief that blackmail is more often a correct description of such dealings than bribery. The agent who will accept a bribe will not hesitate to demand it plainly. He runs little risk in so doing, as it is only "one man's word against another's." He is the man in the fiduciary position. He draws his salary, and can practically compel the seller, who is dependent on the order for his actual living, to pay up.

Take the case of an electrical engineer in charge of works, and a commercial traveller. The former is safely entrenched in office. The latter is bound to get business or starve. Perhaps his commission on the order is somewhat elastic; or it may be arranged permanently on a liberal scale to provide for such contingencies. The interest of such a man is to keep it all for himself. He is not likely to give money away in lumps unless compelled, nor to offer it to an honest man. No one tempts an honest man twice (for fear of physical inconvenience). And he will make careful inquiries before tackling a second man, who is not known to be dishonest. It is our belief that the advances are made, in nine cases out of ten, in the first instance by the buyer's agent, who is thereby betraying his trust.

We, therefore, suggest that a clear distinction should be made under the new law between the man who is in a fiduciary position, and the man who is not. Assume, for the purpose of the law, that all such payments are trade discounts belonging to the principal; and treat the buying agent who pockets them as a common thief. Whether the other party to the crime should go altogether unpunished on turning informer, is a delicate question. It would seem desirable in the interests of finding out. In such circumstances, blackmailing would become impossible, as the blackmailer's risks would be altogether too heavy.

For the rest, education of public opinion may, after all, prove the most complete remedy. No honest man should lose an opportunity to condemn such practices. The great Institutions should miss no chance to purge our trade. University professors should give at least one lecture every session on professional conduct. With the rising generation lies the future. If it learn to hate the loathsome thing, and to shun all who practise it, it will die out, and the British character, supposed to be typical of rugged fearless honesty, will be saved in all its sterling value.

These are the true remedies: fearless punishment of the blackmailer, social and commercial ostracism of the tempter, the payment of adequate salaries, the selection of men fit, not only in knowledge, but in character, for positions of authority, and above all, the creation of a strong, well-informed public opinion.

The Canals Royal Commission.

It was announced on Monday that a Royal Commission had been appointed to deal with the subject of our canals and waterways, the scope of the inquiry to include their present physical and financial position, the cause of their obsolescent condition, the improvements that are required to complete a satisfactory system, the prospects of success if improvements are made, and the best system of control and finance. We give the names of the Royal Commissioners in another column.

The *Standard*, in commenting on the subject, takes a cautious view, and while recognising the high status of canal navigation in Germany and Belgium, does not consider that canals in Great Britain must necessarily be equally effective if placed on the same plane. To this we would answer that the British canals were a complete success before the advent of railways, and that railways have been quite as competitive in Germany and Belgium as they have been here. It may be true that Belgian canals cost less to make, being comparatively lockless, but it is equally true that Belgian railways have few heavy works to render them costly; and if British canals will cost more because of heavy works, have not the same causes worked against the competitive British railway? Both means of transit are on a par in this

respect. In one sense we have little sympathy with the movement for canal *revivification*, but it is only a lack of sympathy with the idea expressed in the italicised word. Our sympathy goes with reconstruction. Of most of the existing canals we consider that little of value remains beyond the right of way. The canals were originally well engineered. The railways followed the canal routes very largely; the canals were often not far from the roads, and the roads were often the lineal descendants of the old pack-horse ways, so that the whole were rather evolved by a process of survival or the natural selection of the easiest route. To be a success, the new canals must be wider and deeper, and must have banks that will stand some wash from propellers, for the mode of propulsion will be either by steam or gas power, or by electric traction from the banks. On the Bridgewater Canal small tugs haul several loaded barges; this canal pays well, and, despite its 90-ft. ladder of locks at Runcorn, carries more goods between Manchester and Liverpool than any railroad.

What undertaking could have had greater set-backs than the Manchester Ship Canal? Yet it is of immense benefit, not, perhaps, yet to shareholders, because of the mistakes of financiers, but to Lancashire. Indeed, this canal and the Bridgewater Canal, which belongs to the same company, are powerful witnesses to the fact that the country needs canals, and that if properly managed they will pay. We should like to see the canals reconstructed on a sound engineering basis. Ladders of locks must be replaced by hydraulic lifts, as at Anderton, on the Weaver. Locks, where retained, require to be double, *i.e.*, a wide and a narrow lock side by side, so that with the same width of lock entrance several boats can rise together, so as to avoid the delay of passing each boat of a convoy separately. Due provision must be made for lockage water. The summit levels in Lancashire and Yorkshire are fed from high moorland reservoirs of large extent; these are still extant. In other localities pumps may be required to supply the summit levels. No doubt all these points will be inquired into, but let it not be forgotten that this country contains the finest example of a locked ship canal in existence, and that one of its oldest small canals that has preserved its freedom from railway control is to-day a magnificent property, even though it is but small. These two samples alone should be a good answer to those who look with doubt on the future of canals, while the South Lancashire Railways would, if they spoke honestly, testify to the huge benefits they have secured as a result of the Manchester Ship Canal.

Leyton Tramway Contract.

Our remarks on the specification for overhead material, in our issue of February 2nd, have received the attention of the local Press, the Ratepayers' Association and the Leyton District Council during the past weeks. Our lay contemporaries supported our call for an investigation, and the Association addressed a letter to the Council, with the result that a lengthy discussion took place at the meeting of the latter on Tuesday last week.

It cannot, however, be said that much benefit was derived from the Council's deliberations. The Electrical Review was freely abused, in accordance with the procedure customary in such cases, our policy of upholding the true interests of the ratepayers being characterised as "notoriously anti-municipal," and the real issues being smothered in a cloud of verbiage, as the wily octopus emits a cloud of inky fluid to baffle its opponents.

As regards our attitude towards municipal trading, it is, we believe, identical with that of the whole of the technical Press. We are not anti-municipal at all. We applaud the due performance of their legitimate functions by municipal authorities, but we protest against their incursion into the realms of trade, and their unreasoning opposition to private enterprise of almost every description.

As for the question at issue, we observe that the chairman of the Electric Lighting Committee commended the action of the electrical engineer in specifying the sources whence materials were to be obtained, and regarded it as a quite usual occurrence. The fact that this proceeding reduces so-called "open competition" to a mere farce was not dealt with.

As we had occasion to point out last week, to name the manufacturer of a given article is to create a monopoly—of all things, the bugbear of municipalities, though they are themselves unexcelled monopolists when they engage in trade—and to place the contractors and the Council at the mercy of the supplier. It is absurd to suppose that bed-rock prices can be secured under such conditions.

In conclusion, we wish to point out that we have not brought, and do not bring, any charges against the Council's electrical engineer; no doubt he is actuated only by the worthiest motives. But we are not here concerned with motives. The fact remains that the specifications should not have contained the names of makers, still less the prices of materials, and facts cannot be disputed.

Electric Lighting of Railway Trains.

The report of Lieut.-Col. Von Donop on the accident in Catesby Tunnel, on the Great Central Railway, makes interesting reading for electrical men. Three of the coaches were lighted with gas; when the train was derailed, the gas went out in every instance, and began to escape freely. Had anyone struck a match, and caused an explosion, what a horrible disaster would have ensued! Of the two electrically-lighted coaches, one was put in darkness, but the other remained lighted, and its light was invaluable in facilitating the work of rescue. But alight or not, there was no danger from electricity. Needless to say, the Inspector strongly urges the use of electricity in preference to gas for lighting trains.

The Question Box.

One of the drawbacks to a highly respectable and dignified association, such as the Inst. E.E., is the fact that the discussions are usually confined to the more general and weighty subjects; the little details which are so numerous, and in the aggregate so very important, cannot be touched upon—not even in the coffee-room—except to a very limited extent.

It was doubtless to meet a similar want that the National Electric Light Association of New York instituted "The Question Box." By the courtesy of the editor for 1906, Mr. Paul Lüpke, we have been favoured with a copy of this unique compilation or symposium. It comprises nearly 600 pages, of which 517 are devoted to answers to questions, the remainder consisting of four detailed indexes. From the preface we learn that in 1902 there were 71 questions and 303 answers; last year there were 545 questions, 3,057 answers and 227 contributors, the steady yearly progress proving that the Question Box is filling a want. Not only has the "mailing list" attained to the handsome figure of 7,000 names, but a number of applications for membership of the Association have been received.

The questions are brief, and purely technical: the answers as a rule are equally terse, sometimes being simply "yes" or "no," but where a contributor has more detailed information to impart, a page or more is at his disposal. Most of the answers are interesting; some are amusing; but there can be no doubt whatever as to the practical value of the whole. For this reason we commend the idea to the notice of the members of the Institution, with the suggestion that a similar scheme be set on foot on this side: we do not know whether the American volumes are on sale, but if they are to be had, they are certainly worth purchasing.

THE ONDOSCOPE.

Seeing in the *Archives d'Electricité Médicale* a description of a new instrument, for which acknowledgment was made to Doctor H. Lewis-Jones, we made inquiries which led to an extremely interesting demonstration of the properties and uses of the device, as well as of other apparatus, at the hands of that courteous enthusiast. Having in view the extreme simplicity of the Ondoscope, which was invented by Prof. Ruhmer, of Berlin, the results obtained with its aid are astonishing.

The principle of the apparatus is based upon the discovery by H. A. Wilson, in 1902, of the fact that the violet glow round the kathode of a Geissler tube varies in dimensions in proportion to the current strength, while it is, of course, free from inertia, and therefore follows changes in the current with absolute precision and instantaneity. The instrument devised by Ruhmer to

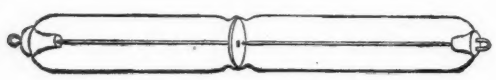

Fig. 1.—The Ondoscope.

take advantage of this phenomenon is shown in fig. 1; it consists of nothing more than two wires sealed into an exhausted tube about a foot in length and 1 in. in diameter, with their inner ends close to a small hole in a mica screen. Viewed directly, when it is connected with the terminals of an induction coil, a steady violet glow surrounds the end of each wire; but when viewed in a revolving mirror, it is seen that the glow occurs alternately on the one and the other of the wires, never on both at once. Moreover, the luminous images, drawn out by the movement of the mirror, show by their outline the changes in the current strength with regard to time, and in its direction. The effect of varying the frequency and duration of make and break, the potential difference applied to the primary coil, and the nature of the secondary circuit, can thus

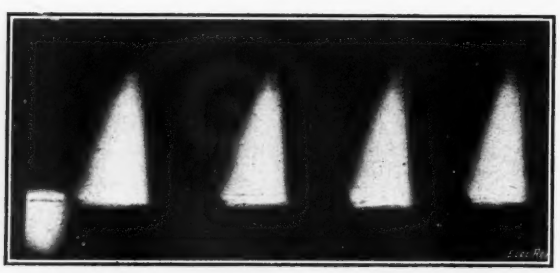

Fig. 2.—Photographic Record of Waves at "Break."

be studied with the greatest ease and convenience. On inserting a Villard valve-tube in the high-pressure circuit, the current becomes uni-directional, though, of course, still intermittent; the appearance of the waves is then similar to fig. 2, which shows the "break" currents only, except for part of one "make" current wave. Using the ondoscope in series with an X-ray tube, with a valve-tube in circuit, the strength of current can be estimated, or even roughly read off on a scale, with the instrument; the latter also serves to verify the fact that all the discharges occur in one direction only, testifying to the efficacy of the valve-tube, which, as Dr. Lewis-Jones showed us, exercises an extraordinarily powerful action as a rectifier. A singular fact which he pointed out was that the discharge through an X-ray tube was practically instantaneous, the luminous image consisting simply of a narrow streak, no matter how rapidly the mirror was turned. By photographing the images, a permanent record can, of course, be obtained.

The ondoscope operates with about 300 volts potential difference, so that it is available for use on ordinary high-pressure alternating circuits; while it is lacking in some of the advantages of the oscillograph, it would unquestionably yield a considerable amount of information regarding wave-form, oscillations, &c., with the minimum of trouble and expense, and it could hardly get out of order.

Not only did it fall to Dr. Lewis-Jones, in conjunction with Dr. R. Morton, to introduce this ingenious device, which had been practically ignored, but we believe we are correct in stating that to him is due the credit also of bringing forward the valve-tube, which has done so much to improve radiographic results, and to render the secondary current through the X-ray tube unidirectional, therefore measureable with a direct current milliammeter. We are greatly indebted to his courtesy in showing us the apparatus.

ROYAL COMMISSION ON TRADE DISPUTES.

The report of the Royal Commission on Trade Disputes and Trade Combinations has recently been issued to the public.

This Commission was appointed on June 6th, 1903, by the Conservative Government then in power "to inquire into the subjects of trade disputes and trade combinations and as to the law affecting them, and to report on the law applicable to the same and the effect of any modifications thereof."

The chairman of the Commission was the Right Hon. Andrew Graham Murray, K.C., M.P., then Lord Advocate in Scotland, and since raised to the peerage with the title of Lord Dunedin of Stenton. The other Commissioners were Sir William T. Lewis, Bart., Sir Godfrey Lushington, G.C.M.G., K.C.B., the Right Hon. Arthur Cohen, K.C., and Mr. Sidney Webb, LL.B., L.C.C.

The conclusions arrived at by the Commission are by no means unanimous, the majority report being signed by the chairman and two members only, namely, Messrs. Cohen and Webb; while independent reports are presented by Sir Godfrey Lushington and Sir William T. Lewis.

The only point on which the Commissioners came to an unanimous conclusion is that they were not concerned with the general policy of the law in sanctioning Trade Unions as institutions. It is noteworthy that the Trade Unions refused to give evidence, the reason given being that they were not represented on the Commission. This fact, however, does not appear to have acted in any way prejudicially to Trade Unions, as the majority report is very much in their favour. It treats the subject under three heads, namely:—

1. The liability of Trade Union funds to be taken in execution for the wrongful acts of the agents of the Union.
2. The statute law relating to picketing and other incidents of strikes.
3. The law of conspiracy as affecting Trade Unions.

Touching on the liability of Trade Unions funds a detailed narrative is given as to the various circumstances which have led to the belief that Trade Unions were immune from actions of tort, and that this immunity had been secured by the Act of 1871 as a privilege of Trade Unions. It is shown that, when all the circumstances are sifted, no assurance of such immunity has ever been held out; no public commission as a body has represented that they ought to be exempt; no Government has promised that they would be exempt by forthcoming legislation; and no judge has pronounced that they are exempt. The idea, in fact, is a mere misconception resting on no other foundation than long practical immunity which was simply the result of defects in general legal procedure.

Touching upon the Taff Vale case, the Commissioners, in the majority report, maintain that on the grounds of justice and equity, the objections against disturbing the law as laid down in the Taff Vale case appear insurmountable.

The following extract from the report expresses in very plain language what no fair-minded person would dissent from:—

"There is no rule of law so elementary, or universal, or so indispensable as the rule that a wrong-doer should be made to redress his wrong. If Trade Unions were exempt from this liability they would be the only exception, and it would then be

right that that exception should be removed. That vast and powerful institutions should be permanently licensed to apply the funds they possess to do wrong to others, and by that wrong inflict upon them damage, perhaps to the amount of many thousand pounds, and yet not be liable to make redress out of those funds would be a state of things opposed to the very idea of law and order and justice. But when Trade Unions come in contact, by reason of their own actions, with outsiders, and *ex hypothesi*, wrong those outsiders, there can be no more reason that they should be beyond the reach of the law than any other individual, partnership, or institution."

Touching on the law of agency, the report first points out that Trade Unions are in a somewhat peculiar position in respect to their branches, which are often in a semi-independent position as regards the Union as a whole; and it is looked upon in the nature of a hardship that by some unauthorised act by a branch agent the funds of the whole Union may be rendered liable. It is recommended, therefore, that means shall be furnished whereby the central authorities of a Union may protect themselves against unauthorised and disavowed actions of branch agents. This recommendation is dissented from by Sir Godfrey Lushington, who considers that the inevitable result of any such legislative attempt as is proposed would be to assign to Trade Unions some sort of peculiar rule of liability for the acts of their agents. He appears to be of opinion that the general law is not inappropriate, and that its application has not been found to produce injustice.

Sir William Lewis is of the same opinion, and his view is that if the law of agency is to be altered it must be altered so as to apply generally. On the other hand, Mr. Sidney Webb, in a separate memorandum, quotes from the Government Bill submitted to the New South Wales Legislative Council on October 1st, 1903, in support of the majority report.

On the question of the separation of funds, it is proposed to provide for the separation of the proper benefit funds of Trade Unions. The effect of this would be to make the funds so separated only available for sick, accident, superannuation, and benevolent purposes.

Mr. Webb considers that "out-of-work" funds should be placed in the same position. This view is dissented from by Sir Godfrey Lushington who considers that this is placing Trade Unions in a special position, and points out that in the case of an individual debtor all insurance policies of which he is the beneficiary owner pass to his trustee in bankruptcy. He points out also that in the case of friendly societies all claims on the society must be met before any division of funds is made. Touching upon Mr. Webb's proposition, he further points out that in the accounts of many Trade Unions no difference is shown between payments to men out of work through slackness of trade and payments to men out on strike.

Sir William Lewis, in supporting Sir Godfrey Lushington's objections, points out also that the workmen themselves have always been opposed to the separation of funds, and adds:—

"It is not easy to see why, as a matter of justice, the claims of members to provision made by themselves and for themselves against old age, sickness, &c., should be deemed superior to the claims of outsiders to reparation for the wrongs which those members, as represented by their unions, have committed against them."

On the question of picketing the recommendations of the majority are diametrically opposed to those of the minority report, and we entirely agree with the minority reports in expressing our astonishment at these recommendations in face of the opinions given in the report itself. The recommendation is to alter Sec. 7 of the Conspiracy and Protection of Property Act, 1875, by repealing Sub-sec. 4, and superseding this and also Sub-sec. 1 with the following clause:—"Acts in such a manner as to cause a reasonable apprehension in the mind of any person that violence will be used to him or his family, or damage done to his property."

Discussing the question generally, it is claimed that no workman has ever been punished under the Act for "peacefully persuading." What he has been punished for is watching or besetting a house, &c., with a view to peacefully persuading. It is pointed out that, apart from the act of the watching and besetting constituting under certain circumstances a nuisance, it is a contradiction of terms to say watching and besetting for the purpose of peacefully persuading, because, as shown by the overwhelming evidence of the persons examined, picketing, however conducted, is always, and of necessity, in the nature of an annoyance to the person picketed. "As such it must savour of compulsion, and it cannot be doubted that it is because it is found to compel, that trade unions systematically resort to it. It is obvious how easy it must be to pass from the language of persuasion into that of abuse, and from words of abuse to threats and acts of violence. A considerable proportion of the cases of physical violence which occur during times of strike arise directly or indirectly out of picketing."

In the face of this expression of opinion it is difficult to understand the proposals of the majority to legalise picketing. The proposal is strongly dissented from by Sir Godfrey Lushington, and by Sir William Lewis, and the former quotes the views of the majority, as referred to above, in support of his objections, and concludes by saying: "I am of opinion that picketing is an abuse for which a remedy is urgently required, and that the personal freedom of workmen needs not less protection than hitherto, but more. I, therefore, recommend that the existing prohibition of watching and besetting be retained, and that the proviso permitting it for the sole purpose of giving and receiving information be repealed."

Sir William Lewis considers that the proposal appears to make a new criminal offence, to wit, "causing a reasonable apprehension in the mind of any person" in place of an existing criminal offence of "intimidation." He points out that, having examined witnesses representing every trade and industry in the United Kingdom, such witnesses are unanimous in saying that, in practice, such a thing as peaceful persuasion is unknown. He further adds, "I am at a loss to understand how my colleagues, who, in the majority report which they have signed, have given their opinion as to what 'watching and besetting' is in practice, could have brought themselves to make a recommendation which removes 'watching and besetting' from the list of criminal offences, and *ipso facto* legalises it."

It appears to us to be very unfortunate that the majority, in their report, have recommended an alteration in existing laws so much out of harmony with the general views which they themselves have expressed in the report; and the fact that these recommendations are signed by only three out of the five Commissioners, and that minority reports strongly dissenting from such recommendations are presented by two of the Commissioners, will tend to nullify the effect of the whole proceedings. Speaking generally, we find ourselves in sympathy with the views expressed in the minority reports—which views, curiously, are so well supported by the majority when they say that "there is no rule of law so elementary, so universal, or so indispensable as the rule that a wrongdoer should be made to redress his wrong."

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"Manager" writes:—"In a certain factory piece-work tickets are issued to the men initialled by the manager, but not signed in any way by the men who accept them. During the progress of the work the men are paid at their ordinary day work rates, and on completion of the work the balance (if any) is paid to them. In the event of a man having 'overdrawn' on a piece ticket, can the difference be legally deducted from his day work wages earned on other work, or must the deficit be deducted only from piece work balances made on other contracts? The tickets are handed to the men at the commencement of the work, and are given up by them on completion."

*** So far as can be ascertained, there is nothing in the Truck Acts to make the deductions referred to by "Manager" illegal. It is conceived, however, that it would be prudent to affix a notice in the factory in compliance with Sec. 1 (i) of the Truck Act, 1896, setting forth the circumstances in which these deductions are made. That section provides that an employer shall not make any contract

with any workman for any deduction from the sum contracted to be paid by the employer to the workman, or for any payment to the employer by the workman, or for or in respect of any fine, unless (*a*) the terms of the contract are contained in a notice kept constantly affixed at such place or places open to the workmen, and in such a position that it may be easily seen, read, and copied by any person whom it affects; or the contract is in writing signed by the workman.

"B. E. A." writes:—"I have a slight recollection of a case arising in London some three or four years ago, where an electric light consumer installed a motor-generator, the current for which was charged for at power rate, the generator being used for the purpose of lighting such consumer's premises. This case was taken into Court by the company supplying the current, but I fail to recollect the result. A good report of the above was published in your paper, I am of opinion, but I should be greatly obliged if you could assist me in the matter of obtaining this information."

*** No such case has, so far as we are aware, been decided in England. The subject has, however, been frequently dealt with in articles appearing in these columns, the view expressed being that to use a motor-generator in the manner suggested would be illegal.

LEGAL.

J. Defries & Sons, Ltd., and the Helios Manufacturing Co. *v.* the Electric and Ordnance Accessories Co., Ltd.

This case came before Mr. Justice Joyce in the Chancery Division on 1st inst. Mr. Younger, K.C., and Mr. J. D. Israel appeared for the plaintiffs; and Mr. A. J. Walter and Mr. J. C. Gray for the defendants.

Mr. Younger, in opening the case, said it was an action brought by the plaintiffs for an injunction to restrain the defendants from selling and passing off arc lamps under the name of the Stewart arc lamps without properly distinguishing them, and the case was somewhat peculiar in its facts and raised one or two interesting questions of law. In general outline the nature of the case was as follows:—The second plaintiffs, the Helios Manufacturing Co., were an American company, whose predecessors in interest for a considerable number of years past manufactured a certain form of arc lamps and other electrical appliances, which had been introduced into the English market, and under the name of the Stewart lamp, had acquired a very considerable reputation. The way in which these lamps were introduced into the English markets, and were sold, and acquired the name of the Stewart, was this: In 1896 a gentleman of the name of Stewart, being in America, entered into an agency agreement for the pushing in Great Britain of the sale as agent of, amongst other commodities, these arc lamps of the American company. Mr. Stewart came over to England, and shortly after he arrived he formed a syndicate which might be shortly described as the Stewart Electrical Syndicate, Ltd., which, in the first instance was largely the creation of Mr. Stewart, and to which Mr. Stewart, by agreement, assigned the benefit of this agency, and himself entering into an agreement as the electrical manager of the Syndicate. The Syndicate then proceeded to place this American lamp upon the English market. In the course of its career it did, in fact, under the name of the Stewart lamp, and acting as agents under this arrangement, sell a very considerable number of the lamps in the English market, so that the lamps acquired a reputation for excellence, and became known to the public under that name. He thought it would be established in point of fact that no lamps sold by the Syndicate under that name were not of the American company's manufacture. What happened to the Stewart Syndicate was this. It was apparently in other branches of its business not very successful, and in 1903 a receiver, at the instance of debenture-holders, was appointed, and it either went into liquidation or was wound up. Thereupon the agency for the sale of these lamps was determined, and that agency and the right to sell these lamps in England, had passed by contract to the first plaintiffs. The receiver was minded to dispose of the assets of the Syndicate to the best advantage, and he sold to the first plaintiffs certain of these lamps which were in the possession of the Syndicate, and he offered for sale by public auction the goodwill of the Syndicate, with the right, so far as he was able to compel it, to attach the word "Stewart" to electrical appliances. At that sale by auction the defendant company, acting through its manager, Mr. Bate, who had been for a considerable number of years the electrical manager of the Syndicate, paid £95 for the goodwill, and accordingly the goodwill of the syndicate was assigned and transferred to the defendant company.

His Lordship: With the express right to use its name?

Mr. Younger: Yes, so far as it could be conferred.

His Lordship: The case raises a very interesting point.

Mr. Younger: Oh, yes, it is a very interesting point, and they are selling other lamps altogether under that name. Continuing, the learned counsel said the first question his Lordship would have to determine, was whether the defendant company were entitled to apply the description, Stewart arc lamps, to arc lamps manufactured in England, and nothing to do with the American company's lamps at all, thereby representing that they were, in fact, the same lamps both in point of quality and construction as supplied by the Syndicate. The other question which was raised by the defendants' counterclaim was whether defendants were entitled to stop them from applying the word "Stewart" to the real old original lamps, which were the lamps manufactured and sold through the Syndicate to which he had referred.

On Friday, March 2nd, Mr. W. N. Nelson, examined by Mr. Younger, said he was about six months with the Syndicate. During that time the Helios lamps were supplied to the Syndicate through Messrs. Peck. A few sample lamps, called the Pioneer, were sold by the Syndicate for a time, but they were not satisfactory. These lamps were sent by another manufacturing company in New York, and were never sold under any other name but the "Pioneer lamp." The Helios Co.'s lamps were always sold under the name of the Stewart lamp. During the time he was with the Syndicate, no lamps were sold under the name of Stewart, except those which came from the Helios Co. He received from the Helios Co. some literature with regard to these lamps, and that literature described the lamp as the Stewart lamp. During the time he was with the Syndicate, the main portion of their business was the sale of these lamps. The other part of the business was the sale of rheostats and electrical appliances. The name of Stewart was not attached to these articles. There was a German lamp in the market called the Helios lamp. He, however, had never known that lamp to be sold in England.

His Lordship said he should have thought that if a small alteration were made in the form of the advertisement that would have put an end to the whole case.

Mr. Younger said plaintiffs' case was that the name, Stewart arc lamp, had never been used in this country except on lamps manufactured by the Helios Co.

His Lordship said there was no question of trade mark or monopoly, nor did he think there was any question of real actual fraud. Each party insisted upon doing what that party was doing, and the only question to his mind was whether the defendants were doing that which was a fraud at common law. That was the question. The case had nothing whatever to do with the Trades' Marks Act, or anything else except whether the defendants were representing the goods they sold to be manufactured by the plaintiffs.

In answer to his Lordship, Mr. Walter stated that defendants did not care an atom about retaining the No. 632 in their advertisement. He said the defendants were the only persons entitled to use the name of Stewart.

His Lordship: It is not a question of Stewart. It is not a mark. The only question is whether you are committing a fraud, and I do not think you are committing afraud.

Mr. Walter said that defendants had never represented that the lamp they were selling was a lamp manufactured by the Helios Co.

Examination continued: The lamps when they arrived in England occasionally required adjustment after the voyage. Sometimes the case would get jammed or the mechanism injured. The lamps were made for different voltages. With that exception, the lamps were sold as they came from America. The Stewart Co. had no laboratory at first, but later on they had. The Helios Co. was a fully-equipped manufacturing company.

Cross-examined: In the summer of 1896 he was in the States. He had been employed by Mr. Edison for some years. He was minded to set up business in that country as a dealer in electrical machinery. Messrs. Peck were old friends of his, and he made an arrangement by which they were to buy goods for him in America and send them over to this country, and then he was to sell them here. When he first came over the lamps he had at first were called the Pioneer lamps, but those lamps were not manufactured by the Helios Co. The Syndicate had the benefit of his agreement with Messrs. Peck. Open alternating lamps were sold in his time. The Stewart Syndicate paid all the cost of their own advertisements. The Syndicate were building up a business, and as part of their business they sold Stewart arc lamps by their advertisements. The Helios Co. was an unknown firm so far as this country was concerned. He and the Syndicate were building up a business under the name of Stewart; at least that was so until he left.

After some further evidence had been given, his Lordship intimated that he thought the plaintiffs had made out no case on the claim.

Mr. Younger said that if that was his Lordship's opinion, it was waste of time to go on with the case further.

Mr. Walter then opened the defendants' counterclaim. He said that the defendants were dealers in electrical appliances, lamps, motors and everything of the kind. The lamp as introduced from the States was quite unsuitable for the English market, and about a dozen changes were made in it by the defendants' servants and from the defendants' instructions, and then there was a lamp produced suitable for the English market. The Syndicate had built up a connection with the name Stewart, by which was meant the Stewart Syndicate. The man who did everything in connection with the Syndicate was now the manager of the defendant company. He was the man who had made every one of these improvements, and the defendant company had bought the goodwill of the Stewart Syndicate. He had abundant evidence that the Stewart Syndicate meant the Stewart Syndicate and nothing else. Plaintiffs had flooded the country with advertisements and threatening letters and circulars stating that they were the sellers of the Stewart arc lamp, and that nobody else was entitled to sell them. The learned counsel submitted that defendants were entitled to restrain the plaintiffs from doing this.

Mr. D. C. Bate, examined, said he was now sales manager to the defendant company. In April, 1897, he became manager of the

Syndicate after Mr. Stewart left. He remembered the lamp sent over by the Helios Co. The condition in which it was sent over was not suitable for the English market. He made various alterations in the structure of the lamp, and so made it suitable for the English market. He bought the lamps from Peck's, and they were paid at first 10 per cent. commission and afterwards 5 per cent. He took a large part in the building up of the business of the Stewart Syndicate himself. Plaintiffs had issued an advertisement and circularised the trade, saying they were the sellers of the Stewart lamp, and that nobody else was entitled to sell them. That had done great damage to the defendants' trade.

Cross-examined: They claimed the right to use the word Stewart by reason of the purchasing of the goodwill of the Syndicate and by reason of the assignment.

Mr. Wilfrid Defries having given evidence on behalf of the plaintiffs in opposition to the counterclaim, to the effect that he had never applied the name of Stewart to any lamps except those of the Helios Co.

In the result his Lordship, in giving judgment, said he could not assent to the proposition that the word Stewart belonged in any sense to the American company. In his opinion—of course, he might be wrong—the word Stewart was the sole property of the Stewart Syndicate. He thought the right use of the title "Stewart Lamp" belonged to the defendants in the action. Under these circumstances he held that if the American company and their agents were going to sell Stewart lamps in this country they must do it in such a way as to distinguish their goods absolutely from the goods sold by the defendants. In his opinion the defendants were entitled to judgment on the claim, and also to an injunction on the counterclaim, the plaintiffs to pay the costs. Judgment accordingly.

Mountford *v.* London United Tramways Co.

A case was recently heard in which plaintiff, a surgeon dentist, of Kingston, claimed compensation from the defendants in respect of 10 ft. of frontage taken by them for street widening, and in respect of damage done to his practice by the advent of the electric tramways. The defendants contended that the plaintiff's business had fallen off on account of his ill-health and competition of a successful rival. The jury awarded £360 in respect of the frontage loss, and £300 for loss of practice.

Mayor and Corporation of Bournemouth *v.* Poole and District Electric Traction Co.

In the Chancery Division of the High Court of Justice on Monday, Mr. Justice Joyce delivered his reserved judgment in this case. He said that the three items upon which he reserved his judgment were:—Parliamentary deposits, £1,875; sundry debtors, £544; and cash in hand, £14 10s. The question he had to determine arose upon an agreement of March 11th, 1903, between the Poole Electric Traction Co. and the Corporation of Bournemouth for the purchase of the Poole Electric Traction Co. by the Bournemouth Corporation. The Poole undertaking was to mean the light railways and works of the company constructed under the Poole Order, and all real and personal property belonging to the company for the purpose of the railway works, or the management or working thereof. The question he had to decide was whether, upon the sale of the Poole undertaking as a going concern, the three items he had mentioned did or did not pass to the Corporation. He must say, looking at this agreement, he very much doubted whether the intention of either party was directed to these particular items, but he had to take the agreement as he found it. He came to the conclusion that all these three items did belong to the Poole Traction Co. in connection with the railways and works, or management thereof, and therefore passed to the Bournemouth Corporation. All questions of costs would be reserved.

The Cooper Patent "Anchor" Rail Joint Co., Ltd., *v.* The London County Council.

(*Continued from page* 334.)

Mr. Cripps, K.C., continuing, said that what ought to be borne in mind in considering Mr. Cooper's invention was the difficult nature of the problem which had to be faced, as between a joint for the purposes of a railway or tramway laid in concrete and the ordinary fish-plate joint which had been used in connection with sleepers. The difference between the case of a tramway laid on concrete and that of an ordinary railway had not been sufficiently appreciated at first. The old horse cars weighed only three or four tons, whereas the new electric cars were from ten to twelve tons in weight. The greater weight and the greater speed of the new electric cars had to be considered. These things told on the life of the tramlines where the old joints were used before Mr. Cooper's invention. Owing to there being no proper system of jointing, the life of the tramway was very much shortened by wearing of the joints and constant relaying was necessary. As the lines got out of place at the joints there was serious bumping and knocking of the cars, and this further intensified the loss. These loose joints were extremely inconvenient, and the jolting resulting therefrom occasioned discomfort to passengers travelling in the cars. Another serious difficulty was that when loosening of the joints occurred, water got in and pumped the concrete away from the neighbourhood of the joints, further loosening the support which the concrete was intended to give. The pumping action also had the effect of driving some of the granite setts out of place to a higher level than the road. There is, therefore, a double disadvantage to the old system. It sunk the joints, and raised the granite setts. The essence of tramway construction as regarded roads was that the rails and setts should be as nearly level as possible. As regards tramway purposes, it was necessary in the first place that the joints should be rigid. He used that expression in order to differentiate as between a tramway joint and a railway joint. For railways, it was not the practice to have a rigid joint because rails were not laid on concrete, but on sleepers. Before Mr. Cooper's invention, it was not seen that the very element which tended to success as regards a railway joint, tended necessarily to failure as regards a tramway joint laid on concrete. He would show that there was no rigid joint which solved the difficulty until it was solved by Mr. Cooper in the specification of his patent. Another point of considerable difference between a railway joint and a tramway joint was that as regarded the former, room had to be allowed for expansion, as the result of the conditions of the weather. A satisfactory joint for tramway purposes had to be non-expansive. The two conditions in the mind of the railway engineer had to be eliminated from the mind of the tramway engineer. The difficulties with regard to jointing, were not so important in the early days of tramways as they were now. When the large electric cars began to be used, the question of joints became all important both as regarded the effect on the cars themselves, and as regarded the life of the road. The getting of a rigid non-expansive joint in itself did not sufficiently solve the problem. In addition to rigidity some system had to be introduced by which the joint and the rails themselves would be incapable of movement owing to the action of what was sometimes called the sinking action of the cars. What tramway engineers were on the outlook for and what they did not discover until Mr. Cooper's invention, was some system by which they could anchor the rigid joint. An essential part of Mr. Cooper's invention was that he had a lower piece of rail riveted underneath the rail of the tramway, and embedded or anchored in the actual concrete foundation on which the tramway itself was constructed. This method of getting rigidity by means of anchoring or keying the joint down to the concrete, solved the difficulty which had occasioned an immense amount of research. A great deal of money had been thrown away, because owing to the unsatisfactory joints a number of the early tramway systems had to be taken up and Mr. Cooper's system introduced. It was practically universally adopted in connection with the tramways of all great towns. The London County Council paid the plaintiffs royalties in respect of user, but after a time they thought they could upset the plaintiffs' patent, and that was the reason why the present action was brought. Another matter which had to be considered as regarded the joint was the importance of bonding. The plaintiffs' joint was admirably adapted for preventing loss of electrical conductivity. The method of attachment was such as to ensure conductivity. By fastening the piece of rail underneath, the current was allowed to pass the joint without loss. In connection with some tramways a bonding piece of copper was used, but with plaintiffs' joint the copper bond was no longer necessary. Tramways laid with plaintiffs' joint without any provision for bonding except that obtained from the joint itself had so far been found to work perfectly satisfactorily. Bonding, however, might be used in connection with plaintiffs' joint; but, having regard to experiments and to the experience of the plaintiffs, they considered that the copper bonding was not necessary. The anchor rail-joint really provided an electrically continuous rail. It combined the advantages of a welded joint without any of its disadvantages, and with the important addition of anchorage to the concrete under-bed. Its advantages were summarised as follows: — The only joint that securely anchors the rails to the concrete under-bed, and prevents them rising, sinking or working loose; efficiency much greater than with any other form of joint or sole-plate; has great horizontal and vertical rigidity, and is the simplest and most perfect joint made; life of track very largely increased, and necessity for constant packing prevented, thus effecting great economy in maintenance and renewals; by ensuring a smooth track, prevents noise and bumping at joints, increases the life of cars, saves expense in repairs to motor gearing, springs, axles, tires, &c., in addition to increasing the comfort of passengers. It practically provides a continuous rail, and, being firmly embedded in the concrete, neither lateral nor vertical movement is possible, the rails being thus maintained in perfect alignment, level and gauge. The joints being made absolutely rigid, the bond pins are not shaken loose. It has the further advantage of providing a path for the electric current to pass from rail to rail, thus safeguarding against leakage of current and electrolytic action on adjacent pipes, &c. Spring, hog-backing and creep, which cause serious trouble, are entirely prevented by its use. Proceeding, the learned counsel read the plaintiffs' specification, contending that it was one of the plainest and the simplest it was possible to conceive. The defence raised in substance was want of novelty. All the American specifications which the defendants relied upon, so far as he could see, referred to old railway construction as apart from the new tramway construction, and instead of assisting the tramway engineer they diverted his attention to the old railway method, which could not be applicable as regarded tramways laid upon concrete. With regard to the allegations of prior user, Kincaid's chair joint was not one which was applicable at all to what was required as a result of electric traction. It was a joint which was neither anchored nor rigid. In the specifications defendants relied upon, there was nothing approaching the rigid anchor joint which was the subject of plaintiffs' claim. There was no greater test as to

whether there was invention, than that of utility. It was a strong element to find that the invention claimed, provided something which was much wanted, but previously could not be obtained. As soon as Mr. Cooper brought out his patent it was recognised that the joint was of immense utility, and soon came into universal use. Apart from this consideration there was the combination applied for a new purpose and under new conditions.

Mr. James Swinburne was afterwards called by the plaintiffs. He stated, in answer to Mr. Bousfield, that he had studied the plaintiffs' specifications, as well as the bookful of so-called anticipations.

In your view, did this subject of joints at the date before the plaintiffs' patent, present a problem?—Oh, yes; and it presents a problem to be solved now by people who do not use his method.

Does the plaintiffs' anchor-joint solve the problem?—Yes. If you had a rigid rail bed and you could lay the rails on a rigid bed, so that they would not move, you would have a perfectly rigid rail. But, as a matter of fact, there is always a little movement in the rail. What this inventor did was to make an exceedingly rigid joint which also had the property of being anchored down in the concrete, so that it never came away, and there was nothing to give when the car came over it. The result is that the rail becomes practically rigid right along.

Witness, in the course of further evidence, said that, apart from anchoring, plaintiff also made a joint for electric railways which was a good conductor electrically. If you get a joint so strong that there is no movement between the parts, it was possible to get good electrical conductivity. The irregular shape which the joint possessed was necessary for anchoring. The anchoring in the concrete was part of the invention, and necessary in order to get the result.

What was the practice of tramway engineers with reference to rails through which a current of electricity might have to be passed?—They used fish-plates, but the fish-plates did not make a good electrical contact, because there was always some working between the fishplates and the rails. They had a copper bond which stretched from one side to the other, and made a good contact. It was flexible in itself, so it stretched when the rail stretched.

Sir Robert Finlay: I may say there is no question about infringement, but we do not use this for conducting electricity at all. That we use the inverted rail at the joint there is no doubt, but we have a different system, so that the electricity does not return through the rails.

Questioned as to the Anthony specification, Witness said that what that inventor wanted to do was to get a joint as flexible as the railway line. He simply wanted to get a joint which would not tend to go into a V-shape when the wheels were going over it. To make an ordinary tramway like a railway would simply smash the concrete up. Tramway engineers started by copying the railways and got into difficulties, and now the way of solving the difficulty was to depart radically from railway practice. Cooper not only anchored the joint, which was what he claimed, but he also anchored the whole rail, and that part of the invention which was not claimed, was used by other people who anchored the middle of the rail in addition. He thought the whole idea of anchoring down the tramway joints was due to Mr. Cooper, and it was clearly expressed in the specification.

Cross-examined by Sir R. Finlay: Apart from the tram rails being at the same level as the street, elasticity would be just as desirable for a tramway as for a railway, would it not?—No, because it is possible, and, in fact, easy to make the tram rails rigid. Elasticity in a railway means burning more coal. It would be better to avoid that if you could, but you cannot.

Do I understand you to tell me that in your view rigidity would be a good thing in railways themselves?—Yes, I think so, if you could get it. At any rate, it would be a good thing as far as the coal bill goes. If you could get rigidity in the rail at a reasonable cost, you would get it. It is a question of cost *versus* give—it is a compromise.

Having regard to the actual conditions under which you work, you must have the rails on a railway elastic?—Yes.

Plaintiffs' complete specification says:—"My said invention relates to the method of jointing rails for railways, tramways and the like." Where do you get in this specification anything to confine it to tramways?—A tramway means a street railway or light railway. I confine this specification to concrete tramways.

A tramway engineer would approach the patent with his head full of tramways, I suppose?—Yes, and concrete.

That is even more solid. I want to know why you say that railways are to be excluded from this patent?—There would be no sense in using an expression like that if he had had an ordinary railway in his mind.

Further cross-examined, Witness said there were two points in the patent, first the method of securing the two ends of the joint together, and second the anchoring down in the concrete. The application of the inverted rail, or its equivalent, riveted or secured, was old as applied to the ordinary railways, but it was new as regarded tramways, and there might be invention under certain conditions in applying it to this particular case. The joint in McNail's patent was exactly the same as in Leslie's patent, and in the plaintiffs.

Then the novelty in plaintiff's patent is in bedding the joint in the concrete?—Yes, the novelty is taking an old joint if you like to put it so and embedding it in the concrete, but you use the joint to some extent in a different way. All these joints mentioned in the defendants' particulars have been rail joints of the same mechanical principle, so far as the iron goes, as Cooper's, but they are working in different circumstances, because there is expansion and contraction in them, and they are not supported underneath.

You agree with me that the process of anchoring supports for the rails into cement is old?—No, I do not think it is.

It is as old as De Féral?—No; his rails are very thin things at the top, and he has simply used sorts of chairs; they only go down about the depth of the setts—that is, no more anchoring than the plates.

Re-examined by Mr. Bousfield: Leslie's joint was not one which could be made absolutely rigid like the plaintiffs'.

Mr. Ernest Matthew Lacey, M.I.C.E., of the firm of Lacey, Sillar & Leigh, Westminster, said he had advised the Corporations of Rochdale, Barry, Colchester, Batley, Belfast and Swindon and Trafford Park in regard to their tramways, and in 1897 he was concerned with the Blackburn tramways. In the work that was done with the Blackburn tramways in 1897, they used a six-hole fishplate on a portion of the section, and the six-hole fishplate and a soleplate on another portion. It became necessary to relay the tramway about two or three years afterwards.

Into what condition did the tramways get in that time?—They were in very bad condition. Of course, it was rather a light rail that we used, and that had also to do with it; but using these heavy cars, which weigh loaded anything between 9 and 12 or 14 tons, the old form of joint, the fishplate joint, or the soleplate joint is absolutely no good.

Was the trouble mainly at the joints?—Yes, because at that time we were using a 45-ft. rail only. Now we are very often using a 60-ft. rail, and we find it necessary to anchor it at intermediate places.

Answering further questions, Witness said the water action underneath the joint as the result of using only a fishplate or soleplate gradually made a cavity, the concrete was worn away, and the pumping action displaced the setts. A hammering action was also created at the joint owing to the jumping of the car. The leap-frog action of the car tended to flatten the wheels, and heavy costs were occasioned in maintenance. Before the date of plaintiffs' specification there most decidedly was a want of a rail joint suitable for tramway work. At first he was not at all satisfied as to whether or not the anchor rail joint was one that would meet the difficulties. He tried it experimentally at Blackburn about 1899 or 1900, and found it so satisfactory that he had used it ever since.

Have you in any of your works used the Cooper anchor joint alone, omitting altogether the bonding?—Yes, I had some done at Blackburn as a trial, and I found on testing as good a conductivity over the rail joint as over an equal length of rail.

Were some of them actually laid down in that way without bonding?—Yes, I believe they are there now. I do not know if they have been bonded.

In your general experience as a practical engineer, has the use of an anchor joint of some kind or other become almost universal in tramway practice?—Well, of course I have used it on a good many tramways. I think there are some engineers who still do not use it, but there have been many serious cases of tracks breaking up where anchor joints have not been used.

And if you were advising in future as regards the laying down of any system of tramways, would you advise or not the use of the anchor joints?—I should certainly advise the use of the anchor joints.

Cross-examined by Sir R. Finlay: With regard to this bonding for conductivity, do you regularly dispense with copper bonding?—No, engineers always like to have a very good factor of safety, so I prefer to put in either a single or a double bond in addition.

When the hearing was resumed on Wednesday, February 28th, Mr. John Nicholls, Clerk of the Works to the Wigan Corporation since 1888, examined, said he had had a large experience in the laying of tramways in the various parts of England. He described the system in use prior to 1898 with regard to the construction of lines and joints then in use. The old joints were not satisfactory. Water got in and set up a pumping action, and ultimately necessitated the track being relaid. He considered that the anchor joint had solved the problem. It was a very satisfactory joint.

This being the plaintiffs' case, Mr. Dugald Clerk was called on behalf of the defendants. He said he had carefully considered the plaintiffs' specification, and he saw nothing new in it.

Looking at the patent, do you find that anchoring is part of the invention claimed or as the invention?—No.

Mr. Bousfield: That must be a question of construction.

Sir R. Finlay agreed.

Further examined, Witness said his view was that the invention was clearly applicable, first to railways and then to tramways. It was applicable both where the rail was above the level, and where the rail was below the level. Plaintiff appeared to think he had made a new joint. Invention had nothing whatever to do with the setting in concrete. That was referred to as an advantage, but it was not referred to as part of the invention. He could hardly think of engineering construction that did not have anchoring. Leslie, in his patent, specified an inverted rail as one method of making a joint. It had long been known that a tramway must be of rigid construction, not because it was the best for running smoothly, but because if there was not rigid construction it would throw up the roadway. Concrete beds for tramways had been in use for at least ten years before the date of plaintiff's patent. Kincaid had a series of holes dug in the track, then he put in his chair and filled up with concrete leaving room enough for the setts. Witness could see no novelty whatever in anchoring. One used it in every possible engineering construction. Leslie, McNair and other specifications had the same object as Mr. Cooper, and that was to produce a strong and rigid joint.

Cross-examined by Mr. Bousfield, Witness said he was afraid very few engineers would rely solely on plaintiffs' joint for con-

ductivity. They tried to supplement even a copper bond. One could not be too careful with regard to conductivity in connection with tramway construction. He did not know Kincaid's system personally, but he understood that it was very largely used in the neighbourhood of Leeds and Sheffield. Kincaid's railway would be much more rigid than an ordinary railway. Kincaid disappeared in a few years' time, and was replaced by the girder rail laid on continuous concrete with either fish-plate or sole-plate joint. In Kincaid's case there was no question of maintaining the rigidity of the joint. In a railway joint, riveting to make the thing absolutely rigid would be fatal. Certain joints were sometimes made rigid on railways, but it was always necessary to leave room for expansion. You dare not allow long lengths of rails to be absolutely rigid.

Mr. Winslow, a tramway engineer, also gave evidence in support of the defendants' case.

Sir R. Finlay, in summing up the case on behalf of the defendants, submitted that there was no novelty in the anchoring of the joint to which the patent was then reduced, and that it was not claimed in the patent. If that was the point of the patent, he (counsel) confessed that he did not from the opening speech in the case, take the impression that that was the one point relied on in the patent. If that was the point of the patent, the patentee ought to have expressed himself in very different terms indeed. No one reading the specification would have supposed that the claim related to the form of the joint and to the superior advantages to be got from the inverted rail bolted or riveted to the rail on which the tram ran. Most of the plaintiffs' witnesses read this specification as only applicable to tramways. They said that the essence of the thing was the anchoring into the concrete. It was impossible to treat the patent as the witnesses for the plaintiff treated it, as only applicable to tramways. It was a specification applicable to railways as well as tramways, and when the claim was confined to the mode of jointing, it would do for railways or tramways. Embedding the rail into concrete was an incidental advantage you would get in dealing with tramways, but it was not claimed in the specification. It was not referred to in the claim at all. The claims were confined to the nature of the joint, the inverted piece, which might be bolted, riveted, or welded to the foot of the rail. Mr. Swinburne had to admit that so far as the claim to the joint was concerned there was nothing new, and he (counsel) submitted that the claim was entirely confined to the joint. The case had undergone a complete transformation. He submitted that there was no invention in what the patentee had done. What the patentee had done was a more obvious application of the discovery (if any) embodied in Leslie's patent. The case was reduced to this—that on the reading contended for by his learned friend, the patentee only pointed out one process for carrying out Leslie's patent. On the other point of the case, he asked his Lordship to say that there was no novelty in anchoring in concrete.

Mr. Cripps then replied on behalf of the plaintiffs, and in the result his Lordship reserved judgment.

Arbitration Proceedings between Dudley Corporation and Birmingham and Midland Tramways, Ltd., Dudley, Stourbridge and District E.T. Co., Ltd., and Wolverhampton District Electric Tramways, Ltd.

This Arbitration was opened at 10.30 on the 27th ult., Mr. Graham Harris sitting as arbitrator appointed by the Board of Trade.

As our readers know already the Dudley Corporation are in the position of purchasers of the various tramways and light railways within their borough; so much is settled, but the price of the undertakings could not be agreed between the parties, and this is the subject of the present reference to the Arbitrator.

The proceedings would call for no particular comment if it were not that they are the first which have taken place in respect of the sale of electrified lines. Many horse and steam tramways have been sold under the Act of 1870 and special agreements, but none which have been constructed for or converted to electrical working.

The particularly interesting points were indicated by Mr. Cripps in the course of his opening on behalf of the company. First, with regard to two depôts which are several miles outside the borough boundary, while not asking that the Corporation should be forced to buy them, the companies propose that a certain proportion of the cars housed in each depôt shall be included in the purchase, as it is not in doubt that a certain number do run over portions of the lines within the boundary. In one case the depôt has a capacity of 66 cars, and the length of line served is but a few furlongs, while in the other instance the capacity is 18 cars or so, and the length served within the boundary is under one mile. It is hardly to be expected that the determination of the proportion of cars to be bought in each case will be the subject of much dispute, but it is not unlikely that the Corporation will inquire how the cars are to be housed seeing that the award may show that there is no freehold depôt within the borough.

The second point of interest concerns two other depôts, of which one is wholly within the borough, the land upon which it stands being held on yearly tenancy. Mr. Cripps suggests that the buildings thereon may be removed by the Corporation! The other depôt is a much more important affair, but the borough boundary does no more than cut a small delta out of the yard. Nevertheless the companies urge that the Corporation is bound to buy the whole, although it is not denied that the cars housed therein are not all used for the purpose of the Corporation undertaking.

The Arbitrator asks pertinently how the Corporation is to get access to this depôt without trespassing over the companies' lines and without going out of bounds into the area of another local authority, for the boundary so runs that two or three hundred yards of foreign territory intervene between the intersection of the boundary line with the tramway and the intersection within the depôt.

Now, further complication arises from the situation of a generating station adjoining this depôt. First of all, the company seek to sell this station to the Corporation as part of the depôt, although it is not denied that no portion of the plant is, or can be, used, under agreement with the Corporation, for supplying electric energy with the borough, but if the Arbitrator rules that this station is not a fit subject for purchase the companies will require right of access in the manner obtaining at present, or the provision of access in some other manner, always assuming that the depôt itself or that part within the borough has to be bought.

Considerable argument arose between Mr. Cripps and the Arbitrator with regard to the basis of valuation of a certain light railway some 550 yds. long, which links the Dudley tramway with the Sedgley tramway.

The company assert that this railway has been used as a link only and not for remunerative service, except under rare special circumstances, and the companies ask that in valuing it "as a going concern," the Arbitrator should exercise some sort of prophetic instinct which, for the purpose of this case, he may be supposed to possess, in order to determine what might be its ultimate value, although at present it is not used. On the other hand, Mr. Cripps could not accept the Arbitrator's suggestion that a going concern might be worked at a loss.

It appears, however, that the words "going concern" do not actually occur in the clause governing the sale of this railway.

On Wednesday, Thursday and part of Friday, Messrs. Ernest J. Bigwood, Alfred Dickinson, Stephen Sellon, H. M. Sayers and others gave evidence on behalf of the companies, and Messrs. W. A. Mason, J. B. Hamilton (Leeds), Alfred Baker (Birmingham), and R. P. Wilson (consulting engineer to the Corporation), on behalf of the Corporation, while on Thursday and part of Friday Mr. Balfour Browne opened the case for the Corporation. Naturally, his arguments followed the same lines as his opponents, and he strove to show that Mr. Cripps was trying to make the Corporation buy one light railway (No. 6) on the basis of structural value, and another (No. 5) as a going concern, because, in the first case, no profits had been earned, while in the other the railway may be supposed to pay well. He showed, as a matter of fact, that both railways must be bought "at a price" to be fixed by the Board of Trade, advised by the Arbitrator sitting as Referee, and that the price must be based on the value of the railways only *in situ*, and apart altogether from any readiness to earn revenue, or from any revenues earned or anticipated. In support of this view, he quoted the Kirkleatham, Stockton and Middlesbrough Water Case, in which the Courts held that of the two awards given by the Arbitrator, one of £27,000, valued as a "going concern," and the other of £8,000, if valued as "plant *in situ*," the latter sum was to be paid to the vendor Corporations.

These railways, Nos. 5 and 6, are put on a different footing to the other railways owned by the companies, inasmuch as their sale and subsequent lease are governed by special clauses in which the words "going concern" do not appear.

During the proceedings, considerable progress towards settlement was made amicably through the good offices of Messrs. Dickinson and Wilson, the consulting engineers for either side. In this way the price to be paid for the permanent way, cables and overhead work of the whole of the tramways was arranged, while the price of the various types of car, and the actual number in two cases were agreed as well. There still remain outstanding the great questions of the light railways and the depôts, and these were due for discussion on Thursday the 8th inst., and the two following days.

Hands *v.* Willetts & Co.

In the City of London Court on Monday, Mr. Albert C. Hands, manufacturer of electric light fittings, of Snow Hill, sued Messrs. Willetts & Co., electrical and sanitary engineers, Westcliffe-on-Sea, for £14 for the hire of a stage arc light. At the Southend Regatta last year, defendants wanted a Navy searchlight to illuminate the carnival and evening sports, and they asked the plaintiff to get one. Plaintiff said that the genuine article would cost hundreds of pounds, and the defendants agreed to take a stage arc light at £2 10s. a day. They kept it for a month. Defendants now said that the stage light did not show up the carnival, and that they had to procure a regulation searchlight. Plaintiff's article was like a magic lantern affair. It would not shine more than 200 yds., whereas the searchlight which was obtained, and which cost £5 for the day, was to be seen 7 miles off. Judge Lumley Smith, K.C., found for the plaintiff for £8 10s., to which the plaintiff said he was willing to reduce his claim, and costs.

Edison & Swan United Electric Light Co.

Mr. M'Naghten, K.C., appeared before Mr. Justice Warrington on Tuesday in support of a petition to reduce the capital of this company from £941,090 to £888,071 by writing off 5s. from a certain number of the "B" shares. The company when it started, bought a very large number of valuable patents, which had now lapsed. The patent account stood at £117,820, but there was nothing to represent it except, possibly, the goodwill there might be in respect of once having had the patents.

There being no opposition, his Lordship granted the petition.

A St. Helens Tramway Claim.

(*Concluded from page* 334.)

Mr. Harry England, tramway manager of Wakefield, was of the opinion that the car was carelessly or furiously driven round the curve, and that the trolley consequently left the wire, and the boom struck the span-wire. Witness thought that the wire then became engaged between the trolley head and the wheel. There was no indication of a bad attachment of the line wire to the ear.

Mr. J. McElroy, manager of the Manchester Tramways, concurred in the evidence given by the previous witness. The trolley head used in the case, he said, was not detachable. To come off, it would have to pull out the cable inside.

The jury found that the accident was caused by the negligence of the Corporation alone, and assessed the damages at £1,100, this sum being £2,500, less £1,400 in insurances. Judgment was reserved.

On February 28th his Lordship gave judgment in accordance with the verdict. Mr. Kennedy said that it was not proposed to proceed any further against the Tramway Co. His Lordship therefore gave judgment for the latter.

PARLIAMENTARY.

Ascot District Gas (Electric Lighting) Bill.

This Bill came before the Court of Referees on Tuesday, when the *locus standi* of Messrs. Foote & Milne, petitioners against the Bill, was considered. Mr. Hutchinson, who appeared for the petitioners, said that his clients were the promoters of the Sunningdale and District Electric Lighting Order, 1906. The powers of that order would, if granted, be transferred to a company yet to be formed. The object of the gas company was to secure the supply of gas and electricity in their own hands, and they were opposing the order of Messrs. Foote & Milne. His contention was that while the gas company was an incorporated company supplying gas, the fact that they were taking power to supply electricity introduced a new element of competition. The gas company said that as Messrs. Foote & Milne were not before the House with a Bill, they were not entitled to be heard. Counsel mentioned several precedents. He asked the Court to grant a discretionary *locus* under Standing Order 129. Mr. Vesey Knox, for the gas company, said that it would have been impossible for them to have adopted the Electric Lighting Acts, and the Board of Trade had no power to authorise the use of their funds for electric lighting purposes. Therefore, they had to bring a Bill before Parliament. The petitioners had no works in the district, and their only claim to be heard was that they had applied to the Board of Trade for a provisional order. So far as he knew, the petition of Messrs. Foote & Milne was that they had orders to supply in other districts, but not in that of his company, and that so far they had made no use of those powers. The Court allowed the *locus* against the electrical portions of the Bill.

Wireless Telegraphy Bill.—In the House of Commons on February 28th, Mr. Buxton, in moving the second reading of this Bill, stated that it was a Bill to extend the existing Act, to which no objection has been taken by any of the parties interested. In view of some objections which had been taken to this being made a permanent Bill, he proposed, on going into Committee, to limit its duration to December 31st, 1912. The Bill did not vary in any particular the provisions of the existing Act. According to the *Times* report, Mr. Hay complained that the Postmaster-General had given no reasons for continuing the Act for six years. Wireless telegraphy was being continually developed, and, in view of the commercial and national, as well as the scientific, importance of the matter, some further explanation should be given before the House tied its hands for this long period. Mr. Buxton explained that the original Act conferred upon the Postmaster-General the power of granting or refusing licences in regard to wireless telegraphy. There never had been any intention on the part of the Post Office to deal otherwise than fairly and generously with all concerned, and there had been no complaint from any of the parties during the two years the Act had been in operation. He hoped, therefore, the House would accept this extension Bill. The second reading was agreed to.

The Bill passed through Committee with one verbal amendment on 1st inst., and was reported to the House.

Standing Orders.—On Thursday last week the Examiner of the House of Commons found that Standing Orders had been complied with in the case of the London Southern Tramways and the West Cumberland Electric Tramways Bills.

On Friday last Standing Orders in the House of Lords were found to have been proved in the case of the following Bills:—Folkestone and District Electricity Supply, Mersey Railway, Nottinghamshire and Derbyshire Tramways, and the South Lancashire Tramways.

On Tuesday the Examiner found that Standing Orders had been complied with in the case of the Metropolitan Electric Supply Bill and the Dumbartonshire Tramways Order.

Lancashire Electric Power Bill.—Mr. Snowden has given notice of his intention to move the rejection of the above Bill on second reading.

London Electric Supply Bills.—Mr. Morton placed the following question in the Parliamentary Papers, to be answered on March 8th:—"Whether the First Lord of the Treasury will arrange to send all the electric supply Bills affecting the metropolis to a Royal Commission or a Select Committee to consider and report on the whole subject."

Opposition to Bills.—Mr. A. E. W. Mason has given notice of his intention to move the rejection of the Additional Electrical Power Supply (London) Bill, and Mr. A. C. Morton will move the rejection of the Hammersmith, City and North-East London Bill.

Dunfermline and District Tramways Bill.—It was found on Monday by the Examiner that Standing Orders had not been complied with in the case of the above Bill, which is being promoted under the Private Legislation Procedure (Scotland) Act, 1899. It will remain with the Standing Orders Committee to decide whether the promoters will be allowed to go on.

Kent Collieries, Ltd. (Electricity Supply), Bill.—The Lord Chairman of Committees of the House of Lords has informed the House that the promoters of the above Bill do not intend to proceed further with the measure this Session.

London United Tramways Bill.—The Standing Orders Committee of the House of Commons has decided that standing orders in the case of this Bill shall be suspended in order to allow the Bill to proceed, but on condition that the proposed tramways are struck out of the measure The proposals which are thus struck out comprised two tramways in Brentford, and the powers left in relate to the compulsory purchase of land, rates, and charges, extensions of time for authorised undertakings, and agreements with local authorities.

London County Council (General Powers) Bill.—The Electrical Contractors' Association (incorporated) have deposited a petition in the Private Bill Office of the House of Commons praying that the standing orders may be dispensed with so that they may be heard in opposition to the above Bill, which contains clauses giving the Metropolitan Borough Councils power to supply electrical fittings.

Second Reading.—The London Outer Circle Railway Bill was read a second time in the Commons on February 28th.

The St. Pancras Electricity Bill was read a second time in the Commons on Monday.

In the House of Commons on Tuesday, the following Bills were read a second time:—London Southern Tramways Bill, Metropolitan District Railway Bill, Metropolitan Railway Bill, and North Metropolitan Tramways Bill.

In the House of Lords on Monday, the Cumberland Electricity and Power Gas Bill was read a second time.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Shift Engineers' Holidays.

In reply to the letter of "Shift Engineer" appearing in your issue of last week, I would point out that the conditions he states are by no means universal. All shift engineers employed in the writer's station in London have at least one clear day (24 hours) per week, and every three weeks get a week-end off, and without the hardship of a 12-hour shift. In addition to the above, they either receive the extra payment for all holidays, or have the corresponding number of days added to their 14 days' summer holiday. The above conditions are in force, I know, in several other central stations in London.

Manager and Chief Engineer.

I have noticed at one time and another in the Review several complaints by correspondents, the latest up to the present being "Shift Engineer." Let this console him, there are others infinitely worse off than himself, with a seven days' holiday in the summer, working seven days a week as a rule, and a shift off at Easter and Christmas, if you're in luck, the reward being £52 per annum, with a rise at the millennium, and in one's turn to take charge of nearly £100,000 worth of machinery. This is the modern result of spending hundreds of pounds on one's training and working night and day to obtain a good groundwork; a labourer is a prince compared to it, no study and no responsibility, and with an equal chance of getting on, if not a better chance. Failing an opportunity one may labour for ever and get no further, and it's weary, weary work waiting for dead men's shoes.

In the old days war, famine and pestilence kept down the population; but now none shall die if possible, with the result, such poor wages that we shall have to feed on one another literally and not figuratively, for self-preservation is the first law of nature. A young fellow that climbs to the top now deserves far more credit than one that did so ten

years ago. Then opportunities were without end; one only had to be ready and catch them like over-ripe fruit falling from a tree; but, alas, now the ancient gods have raised up a multitude of "learned" as countless as the sands of the sea. Would it not be wise to have another big eruption or a war of sufficient duration to carry off some of these teeming "learned?" Now they (or we) die like flies ignominiously, but then the Muses would sing for ever their glories, and crowns of laurels would be their share. Then some might have the longed-for opportunity, and rise to shine in their beauty above their fellows. Somewhere I have read, in Gray's Elegy, "Many a flower is born to blush unseen," for lack of opportunity, that is all.

Jupiter Tonans.

The letter of your correspondent, "Shift Engineer," raises a question of great interest to those who are in a similar position and can sympathise with him. Our municipal authorities—and these are in the majority as owners of central stations—together with their chief engineers, apparently regard shift engineers as a necessary evil and treat them as such, for we find that in most stations the drivers and stokers, whose duties can often be carried out by unskilled labour under technical supervision, are allowed to have time off each week. When it comes to considering the shift engineer—if he is ever considered—then, as they are technical men and undertake responsible duties, the question of cost plays an important part, and the shift engineer suffers accordingly.

I think that we deserve more consideration from the powers that be, and that the members of our Electricity Committees should ascertain that the department over which they exercise control is governed and maintained in a manner fair to all.

Most of them make a fetish of "Trade Union rates and conditions of labour," it being a stringent stipulation in all their contracts. We, however, are not "blessed" by a Trade Union or any other body to look after our interests in this respect, consequently these principles are lost sight of in the fever and anxiety of making a profit on the concern. I would suggest that the senior switchboard attendant should be a man who could take a shift engineer's place on light load shifts. Different stations work under different conditions, therefore it would be futile to try and make any one system applicable to all. I believe, however, that a system as suggested has been adopted in some stations with success, and I think that it could be adopted in most cases.

It would add little, if any, to the works cost, while the boon conferred would be greatly appreciated by the recipients.

Seven a Week.

Appointments for Sale.

In looking through the "Situations Vacant" in your last issue, I noticed an appointment offered for the sum of £5. I was filled with indignation when I read it. If this sort of thing is tolerated, what is to become of the man out of employment, however competent he may be, but lacking the bribe, or blackmail, or whatever other name may best suit the demands of such individuals who seek to benefit by the necessity of their fellows? I am not sure if such dealings (to call them by no worse name) are lawful, but at any rate it is a most despicable means of extorting money, in most cases from those who can ill afford it, compared with which the methods of the money-lender and the sweater are philanthropy itself. No respectable employer or firm would adopt such shady tactics, and the only inference to be drawn is that some underling entrusted to "turn off and take on" hands is using his authority to squeeze anyone "sappy" enough to go through the ordeal. I should like to ask the said "sappy one," who may be contemplating a deal, what guarantee he has that, having parted with his money, he will not be "outed" after a few weeks to make room for another premium candidate. The practices of such creatures are disgraceful, and to quote the words recently used by a Cabinet Minister to one of this breed, "I sincerely regret that one of them is not within reach of my boot."

James B. Wardman.

Cleethorpes, *March 6th*, 1906.

Modern Book Canvassing.

Some travellers for books may be all right, but up to the present it has not been my lot to meet one. Some little time ago I had one call on me, canvassing for a book (by a well-known author), which was to be issued in a certain number of volumes, at 9s. per volume. The first volume, which was on turbines, I ordered, specifying on the order form for one volume only, as I have books dealing with the matter which was treated in the following volumes. To cut a long story short, the first volume was sent, with a letter saying that the others would be forwarded in due course, in answer to which I enclosed money for first volume, and stated that I did not require any further issues. The publishers gave me a receipt for the money for the first volume, and sent me No. 2, which I at once sent back. Several threatening letters followed, ending by the Bailiff of E—— County Court calling on me with a summons, and as I hold a chief engineer's post in an Institution, you may, perhaps, understand my feeling not a little put out. I, however, appeared at the court, which they did not, and I obtained costs. Trusting this will serve as a warning—

Wasn't Bluffed.

Steam Turbines.

With reference to Mr. Booth's article on the above, I regret to hear that so much trouble is being experienced with blade stripping. Whether the rumour is correct or not I am unable to say, although I have been actively engaged on steam turbine work for some time. In fact, it is news to me that any serious trouble has been experienced in this direction.

Assuming, however, that there is truth in the rumour, it is the duty of all engineers anxious to promote turbine driving to investigate the cause, and I presume that Mr. Booth's article was written with this object in view.

When criticising the failures of turbines, it should be remembered that several firms, who have hitherto built reciprocating engines, have now taken up turbine building, and it is not surprising that a little trouble is at first being experienced. These remarks apply to no particular firm or firms, but are laid down merely as one of the laws of engineering work. Referring to the steam-attaining temperatures above the specified figure, I quite agree with Mr. Booth that our present superheaters are unsatisfactory in this respect, and until such time as improvements arrive, it behoves all station engineers to rule the boiler house with a firm hand, but judging from experience I do not consider that a reciprocating engine stands at much advantage. Although, of course, according to Mr. Booth's reasoning it should do.

Blade stripping, in my opinion, is due to the following causes:—(1) Starting up before all parts are thoroughly warmed through, and thus not giving time for equal expansion; (2) heavy rushes of water; (3) excessive superheating; (4) through damage being done to the blades on replacing the spindle and cylinder-cover, after opening out. Users of turbines cannot be urged too strongly to employ fitters well trained in this class of work, for it cannot be denied that the interior of a turbine is a delicate structure, and much damage can be caused by inexperienced hands.

With regard to faults in construction that may cause stripping, there are many. The first and foremost is small clearances; these, of course, must be small to allow of low steam consumption, but there is such a thing as knowing how small one may go for a given size, &c.

A badly-balanced spindle may cause a strip, likewise one that is slightly bent. A turbine with these two last-mentioned faults may run very well for some considerable time until it is allowed to go above its normal speed, when the blades may hit the cylinder and become damaged. A very important point to be attended to is to see that all balance pipes connecting the cylinder ends are provided with expansion joints, as a rigid pipe at a much lower temperature than the cylinder may cause the cylinder to warp, if not free to expand.

Much might be written on this very important subject, and, perhaps, at some future time I may be permitted space for an article.

In conclusion, the turbine, in my opinion, is far superior in every respect for electrical driving to a reciprocating engine, and speaking from a long experience with both, the chances of breakdown are about equal.

E. Austin.

Edinburgh, *March 7th*, 1906.

Consumer's Leakage Indicator.

It might interest Mr. J. E. Dawson to learn that I have in use an Esaco electric leakage indicator at the Hackney Borough Town Hall and Baths installation, and I recommended the Guardians to purchase one, in portable form, for the Workhouse installation. Both these have given great satisfaction, the latter saving an immense amount of time, being carried and attached to any circuit at will, and the leakage current, if any, read directly off. These instruments can remain permanently in circuit, as in fact one does, and earth connection is not required. It occurred to me that Mr. Dawson's description referred to an instrument such as this, which was purchased from the Electric Safety Appliances Co., Eldon Street House, Finsbury. I should be pleased to show Mr. Dawson these instruments or furnish him with further information as far as my experience of these goes.

Sidney J. Ross.

London, N.E., *March 5th*, 1906.

Electric Light Flexible Wanted.

It is found that in consumers' premises where the wiring has been installed a number of years, and in many cases the lamps fixed in wrong positions, rendering an undue amount of flexible necessary, that leakage of the current is difficult to prevent. This has been due, in a great measure, to dampness, the flexible having been subjected—through ignorance or carelessness—to rough usage. As a last resource, ordinary flexible was dispensed with, and two separate electric light leads substituted.

Can any maker supply strong, durable, and damp-proof twin leads for use in such cases as cellars, back kitchens, workshops, &c., where the appearance of the job is of no importance, and the protection on the wires would require to be at least double that of good flexible wire?

Megohm.

Warning.

A young man, representing himself as a Frenchman, and stating he was acting upon behalf of a French firm making bleaching machinery, called here last Monday giving us several inquiries for running various sizes of cable in screwed conduit and also for generators. This gentleman gave us the names of several cotton mills, where he stated he had booked orders, but we subsequently found the whole of his statements were pure fabrications. This "Frenchman" stayed at an hotel in Burnley and engaged a horse and trap for the week, but towards Saturday mysteriously vanished, leaving his landlord, owing to some lapse of memory, unpaid! The man is slim, tall, clean-shaven, has dark hair, false teeth both top and bottom; possesses a very pleasing exterior, and can speak fluently several languages.

For **H. A. Jackson & Co.**
A. Bowell-Young, *Manager.*

Blackburn, *March 5th*, 1906.

Fluid Paint Remover.—We are indebted to the correspondents who have very kindly furnished the information desired under this heading.

Steel Pipes.—Messrs. Thomas Piggott & Co., of Birmingham, have recently obtained orders for riveted steel pipes, 63 in. and 78 in. diameter, for export; 12 riveted steel leaching vats, 50 ft. × 25 ft., for West Africa; cast-iron pipes for Birmingham electric power station.

BUSINESS NOTES.

Ship Electric Lighting.—Messrs. J. H. Holmes and Co. have at present in hand contracts for the electric lighting of 38 steamships building in the United Kingdom and abroad. Included amongst these are vessels for carrying Russian troops; petroleum oil in bulk; for the Newfoundland sealing trade; New Zealand and South Africa trade; for Nile tourists; two for the Lancashire and Yorkshire Railway Co.; one for the Great Central Railway Co.; and a large number of passenger and general cargo boats. In addition to these they have in hand several large private yachts. Messrs. Holmes are also overhauling the installation on the ss. *Smolensk*, now lying in the Tyne, which was engaged in the recent Eastern war. The firm equipped this boat with generating plant and a complete installation when she was built at Messrs. Hawthorn, Leslie & Co.'s yard, Hebburn-on-Tyne. The above bring the number of vessels for which the firm have manufactured the generating plant and fitted the installations, up to 800.

War Office Contracts.—The War Office have placed with Messrs. Lightfoot Bros., of Manchester, the contract for the additional electric lighting to the Woolwich Arsenal and Dockyard; Messrs. Ward & Goldstone are supplying the switchboards, fuseboards and various iron fittings, and they are also supplying the switchboards, fuseboards and fittings for the extensions of Waltham Powder Factory.

Bankruptcy Proceedings.—Robert Pries.—An application for an order of discharge was made on March 2nd to Mr. Registrar Brougham at the London Bankruptcy Court, on behalf of Robert Pries, electrical sundriesman, lately trading at 75, City Road, E.C., under the style of Durtnall & Pries. The failure occurred last September; the provable debts amounted to £1,416 10s. 11d., and the assets had realised £44 11s. 11d., from which a very small dividend will be paid. Mr. Walter Boyle, assistant receiver, reported that the bankrupt, a German subject, came to this country without capital in April, 1894. For over seven years he was in employment, but in October, 1901, with £250 given him by his father, he purchased a one-half share in the business of A. H. Durtnall, an electrical engineer, of 82, Bunhill Row, E.C., and Stour Street, Canterbury, Durtnall being then insolvent to the extent of over £100. They thenceforth traded together as Durtnall & Pries until April, 1902, when Durtnall, who had collected, but not accounted for moneys of the partnership amounting to £162, retired from the firm. The bankrupt subsequently traded alone, and in October, 1903, sold the Canterbury business for £250. He made a profit until early in 1904, when the business fell off considerably. In September, 1904, he removed to 75, City Road, E.C., and the following May, upon being pressed by creditors, he realised that unless he could obtain a partner with money, he was unable to pay his debts in full. Owing to subsequent pressure by creditors and the landlord, a deed of assignment was executed on June 7th, 1905, but on the following day the Sheriff levied execution, and stock and effects to the value of £600 were sold for £200, out of which the landlord got £112 with costs. At the present time the bankrupt was managing a business in Hamburg for his mother. He attributed his failure to want of capital, bad trade and bad debts. On the ground of insufficiency of assets to pay 10s. in the £ to the creditors and imperfect books, the discharge was suspended for two years.

Geo. Aaron Benton, electrical engineer, Hatherton House, Shareshill, Stafford (formerly of Muswell Hill).—Receiving order made at Wolverhampton on February 28th on creditor's petition.

Alex. Holmes and Alex. McCallum (Holmes & McCallum, electrical engineers, 29, Victoria Street, Darwen).—First and final dividend of 4s. in the £ is payable on March 8th at District Chambers, Darwen.

H. Jones & G. L. Cathball, plumbers and electrical engineers, Wrexham.—March 21st is the last day for proofs for intended dividend to be received by the trustee, Mr. L. H. Jones, Crypt Chambers, Eastgate Row, Chester.

Catalogues and Lists.—Messrs. Elliott Bros., Lewisham, S.E.—New pamphlet (A.C. 63) describing their portable measuring instruments.

The General Electric Co., Ltd., London, E.C.—A new pamphlet is just being issued, containing illustrated particulars of the "Chubb" patent burglar alarm. The instrument sounds an alarm when the wires are short-circuited or broken, and the bell continues ringing until mechanically switched off at the instrument. Batteries, bells, and electrical device with semaphore indicator are all shown, and prices are stated.

Messrs. C. J. Thursfield & Co., Cecil Works, Clement Street, Parade, Birmingham.—New issue of their general catalogue (230 odd pages), showing a variety of excellent artistic designs of electric light fittings. Numerous pleasing designs of Louis brackets, also hand-wrought and cast brackets in various finishes, plain brackets, table and floor standards, pendant fittings, many electroliers, and ceiling fittings, are included. Messrs. Thursfield have recently opened a suite of show rooms at 21A, Berners Street, London, W., where representative examples of their electrical fittings manufactures can be inspected by the trade. The firm also has branches in Glasgow, Liverpool, Bristol, Swansea, &c.

Messrs. Clarke, Chapman & Co., Ltd., Gateshead-on-Tyne.—Newly-issued catalogue of electric winches, capstans, and haulage gears. Many very clear half-tone illustrations show various shipyard winches, semi-portable single-speed and slipway winches, small whip hoists, single and two-speed capstans, boat and coal hoists,

electric windlasses, electric anchor and warping capstans, double-track winding gear, single-drum, endless and main and tail-rope haulage gears. Brief descriptions and price references appear of each item.

Messrs. S. Wolf & Co., 138, Southwark Street, S.E.—Pamphlet describing and illustrating their high-speed electric hoisting tackle for direct and alternating current, of a lifting power up to 20 tons.

Messrs. Hunt & Hess, Hackney, N.E.—Second edition of their illustrated price list of Litholite standard insulating fittings, containing several important alterations and additions; also two show cards of their "X X" grade for electric railway and other electrical purposes, and of Litholite insulating handles, spanners and bushes.

Messrs. Bagshawe & Co., 2 and 3, Tower Royal, Cannon Street, E.C.—Circular illustrating the firm's "Ewart's" chains for use in collieries, mines and gasworks.

The D.P. Battery Co., Ltd., Lumford Mills, Bakewell, Derbyshire.—Hanging wall calendar for this year. The central feature is an artistic reproduction in colours showing "the great wheels at Lumford Works, with supplemental steam plant, aggregating 1,000 H.P." This is surrounded by half-tone illustrations of the various types of Lumford cells. The company has a few copies of the calendar left for its friends if they will write for them.

The Simplex Steel Conduit Co., Ltd., Birmingham.—Leaflet describing and illustrating the Simplex electric shade tilter, a simple and compact arrangement for canting the lamp and shade at any angle.

Book Notices.—*Constructions of Electric Machines and Apparatus.* By C. Kinzbrunner. Part I.—*Switchboard Apparatus.* Harper & Bros.—This work consists of ten plates of scale drawings of switches of various types, high tension oil fuses, and circuit breaker. The drawings are very neat, and doubtless to students and draughtsmen the plates will be very useful for reference.

Alternating Current Windings: their Theory and Construction. By C. Kinzbrunner. Harper & Bros.—This little book, similar to the "Continuous Current Armatures," contains about 79 pages and seven chapters. The first of these deals with the production of alternating and polyphase currents, then follow the shuttle-wound armature, ring armature, &c. Here, again, calculation of E.M.F. is hardly alluded to, and in the mesh diagrams shown the statements regarding E.M.F. are not proved. Then follow chapters on continuous current windings, dissolved continuous current windings, and polyphase windings which are simply bare statements of facts. The diagrams given on pages 64, 65 and 66 will hardly enlighten any student on polyphase windings. The construction of alternating current windings is dealt with in three or four pages, and then follows a chapter on insulation, in which some of the author's experiments on breakdown voltage are referred to. In this it is stated that for a number of layers n the breakdown voltage is $E_n = E_1 \sqrt{n}$, but on the following page it is stated "dry and impregnated paper are an exception of the above formula," and $E_n = E_1 n$. Most people will conclude that there is something wrong here. Altogether the book is unsatisfactory, since it does not contain a single worked-out practical example of design.

"Science Abstracts." Sections A and B. No. 98, February 26th, 1906. London: E. & F. N. Spon, Ltd. 1s. 6d. each net.

"Cours de Physique de L'Ecole Polytechnique." By M. J. Jamin and M. Bonty. Paris: Gauthier-Villars. 8 fr.

"Repetitorien der Elektrotechnik." Edited by A. Königswerther. No. 6, "Die Akkumulatoren." By Dr. L. Lucas. Hanover: Dr. Max. Jänecke. M. 3.80.

"Modern Milling Machines: Their Design, Construction and Working." By J. G. Horner. London: Crosby Lockwood & Son. 12s. 6d. net.

"Practical Electro-Chemistry." By Bertram Blount. Second Edition. London: A. Constable & Co. 15s. net.

"Manual of Electrical Undertakings and Directory of Officials," 1906. By E. Garcke. London: Electrical Press, Ltd. 15s. net.

Cable Competition in Europe.—The reported intention of the firm of Callender & Co. to open works in Germany, on account of the stoppage of orders from the Continent owing to the high import duties, has attracted the attention of the Berlin *Lokal Anzeiger*, which characterises the explanation of the cause as unfounded in regard to Germany. The English company, the Berlin newspaper declares, has hitherto never entered upon any important competition whatever in Germany.

Consular Notes.— Italy.— The British Consul at Naples reports that the harnessing of water power is now the great problem of Italy. To economise the coal which is now used for purposes for which water power is readily available would cost the country about £4,000,000 of capital expenditure, and this outlay would ensure it a motive power of its own, of perpetual duration, amounting to something like 6,000,000 H.P. The rapid accumulation of capital which the saving of coal would effect, would balance the account in a very few years; and in the meantime, the rent paid for the power would alone be sufficient to pay interest on the capital if a State loan were effected. Private enterprise in this country could not be expected to succeed except after many years of waiting and patience, but if the matter is made one of national concern, not only would the money be readily raised, but the interest and capital would be rapidly paid off.

A great point has been made in the course of the year of the extension of the telephone system. All the chief towns of Italy are now connected, the latest addition to the number being that of Palermo, so that now Palermo can speak with Turin or Venice, that is to say, over a distance of about 1,700 miles. The Island of Sardinia is at present dependent upon radio-telegraphy, the important Government station at Maddelena having been opened for the use of the public. It is the intention of the Government eventually to take all the telephones of Italy into its own hands. This will involve the purchase of all the urban systems, which are extremely numerous and extensive. The total cost per annum at Naples is only £8 per instrument for unlimited service, with a reduction for more than one instrument.

A new direct telegraph service is to be laid on from Naples to Turin, and from Naples to Reggio in Calabia.

The completion of the Circum-Vesuvian Railway in the course of the year has greatly added to the convenience of the public. The new section runs from Naples to Pompeii, and there joins the older part of the line, which makes the tour of the mountain by way of Ottajana, a town situated on the opposite side of the volcano from Naples. The line, which was formerly a light narrow-gauge line, has now been electrified, and connects with Messrs. Cook's Vesuvius Railway.

Indo-China.—Mr. G. W. Pearson, British Consular Assistant in China, reports that there are at present two lines of tramways working in Indo-China—viz., that through Hanoi and its suburbs, and the line from Nam Giang to Kesat. These cannot as yet be considered commercial successes. Two other lines are being started, one from Hanoi to Thai-Ngnyen and another from the same town to Sontay. In Cochin China the working lines are four, viz.:—(1) From Saigon to Cholon (upper road), (2) from Saigon to Cholon (lower road), (3) from Saigon to Gonvap, and (4) from Saigon to Hoc Mon. All of these are financially successful, and the turnover increases regularly. In Annam one line is in process of construction from Tourane to Fai-fo.

Peru.—The German Consul at Lima reports that great strides are being made in Peru in the construction of electric railways; the railway which joins the capital to Callao is in full working, as is also the line between Lima and Chorillos. The latter railway is extremely well patronised, and belongs to the British Railway Co.—Lima-Chorillos. Plans are being made for the construction of a competing electric railway to Chorillos, to be carried out by a German company. Moreover, the Lima Tramway Co. have made an agreement with the municipality to electrify the tramways at present existing within two years, and to make a further extension, 7 kilometres long.

Brazil.—The German Consul at Curityba, in a recent report, states that German houses have had great success in the electrical trade in his district. Not only was the electrical plant in Cusityba installed exclusively by German works, but also those of Paranagua and Ponta Grossa. German houses also supplied the power plant and apparatus for the telephone installations, for which a 10 years' concession was granted. The telephone installations of the civil and military authorities were also supplied by German firms.

For Sale.—Jet condensing plant, &c., at Swansea electricity works. (See our advertisement pages to-day.)

The liquidator of the Electrical Ore Finding Co. is inviting tenders for the purchase of the company's electrical ore finding patents and patent rights until March 12th.

Electricity in an Italian Mill.—We understand that Messrs. Witting, Eborall & Co., Ltd., have recently equipped a wool combing mill in Italy, they supplying the necessary transformers and all the electrical machinery, including switchgear. The supply pressure is three-phase 8,100 volts, and is transformed down to 525 volts for operating the running machinery.

Prices Cancelled.—The British Thomson-Houston Co. announce that their prices of "Thomson recording wattmeters," switchboard type, given in their price list No. 94, have been cancelled.

Russia.—According to the British Commercial Agent in Russia, the idea has been mooted of taxing electrical energy for illumination purposes. Electric energy for traction purposes it is proposed either to exempt altogether from taxation or to tax in minimum dimensions. It is further proposed to tax gas lighting.

A Birmingham Charge.—Last week at the Birmingham Police Court, Francis Joseph Clark, Birchfield Road, Birchfield, manager, and John Troman, 170, Broomsbury Street, foreman, were charged with stealing brass and copper scrap, the goods of their employers, W. Canning & Co., electrical engineers, 88, Snow Hill. Mr. S. S. Dorsett, who appeared to prosecute, asked the Bench to commit the defendants to the sessions on a charge of conspiracy to defraud. The further hearing was adjourned until March 10th.

Trade Announcements.—The well-known firm of A. P. Lundberg will in future be known as A. P. Lundberg & Sons. This change, however, will not affect the management or proprietorship, Messrs. Gus. C. and P. A. Lundberg having been associated with the business for the past 23 years. We have pleasure in announcing that the honour of a Royal Warrant has been granted to Messrs. Lundberg as suppliers of electrical accessories to His Majesty King Edward VII.

The headquarters of the publicity department of Messrs. Bruce Peebles & Co., Ltd., hitherto located in Edinburgh, have now been transferred to the London office of the company, 1, London Wall Buildings, to which all communications intended for the department should in future be addressed. The department, as before, will be under the control of Mr. N. D. Cameron.

Birmingham, have recently obtained orders for riveted steel pipes, 63 in. and 78 in. diameter, for export; 12 riveted steel leaching vats, 50 ft. × 25 ft., for West Africa; cast-iron pipes for Birmingham electric power station.

Newly-issued catalogue of electric winches, capstans, and haulage gears. Many very clear half-tone illustrations show various shipyard winches, semi-portable single-speed and slipway winches, small whip hoists, single and two-speed capstans, boat and coal hoists,

Mr. Jas. Beddow has commenced business as an electrician at 112, Brynn Street, St. Helens.

Messrs. Eckstein, Heap & Co., of 5, Chapel Walks, Cross Street, Manchester, have been appointed by Messrs. Elliott Bros., of Century Works, Lewisham, sole selling agents for their manufactures in the Lancashire, Yorkshire, Cheshire and North Wales district. Mr. Heap was with Messrs. Elliott Bros. a good many years as chief engineer in the design and construction of electrical instruments, and is on this account very familiar with all the technical points of their manufactures. Messrs. Eckstein & Heap have also been appointed sole selling agents for Lancashire, Yorkshire and Cheshire for the British Johns-Manville Co. for their well-known Noark fuses, of which a stock will be kept at the warehouse, Chapel Walks, Manchester.

Dissolutions and Liquidations.—Electroid, Ltd. The company is winding up voluntarily, with Mr. F. L. Jenkins, 17, Ironmonger Lane, E.C., as liquidator.

Yarmouth and Gorleston Tramways Co.—A meeting is to be held at Donington House, W.C., on April 11th, to hear an account of the winding up from the liquidator, Mr. S. Neville Wells.

Messrs. Griffith & Biliotti, electrical and mechanical engineers, 8, John Street, Adelphi.—Messrs. S. B. Griffith and F. Biliotti have dissolved partnership.

Crystal Palace District Electric Supply Co.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. James Gray, Dashwood House, E.C., by April 13th.

Amalgamation.—Messrs. Richard Hornsby & Sons, Ltd., of Grantham, have acquired the old-established business of J. E. H. Andrew & Co., Ltd., of Stockport, makers of "Stockport" gas engines and suction plants. The chairman and managing director of Messrs. Andrew have joined the board of Messrs. Hornsby, and Mr. A. R. Bellamy retains the management of the Stockport branch works. To carry out this arrangement Messrs. Andrew have gone into liquidation, with Mr. Bellamy as liquidator.

LIGHTING and POWER NOTES.

Australia.—Sydney.—The Camperdown Council has agreed to allow the City Council to lay its mains in the municipality without rating, and in consequence a supply of electricity will be available at the same price as in the city. Application for connection has already been received from the University.

Barnstaple.—The total revenue of the Corporation E.L. undertaking for the past year amounted to £4,094, and the total working costs were £2,207. From the balance of £1,887, £898 has been put aside to interest and £720 to sinking fund, leaving a net profit of £269.

Beaconsfield.—The Uxbridge and District E.L. Co. has again asked the U.D.C. for consent to the inclusion of Beaconsfield in the area of supply under the prov. order being applied for, but the Council, although in receipt of a petition from a large number of inhabitants asking it to give the consent asked for, has decided to take no action in the matter.

Bettwsycoed.—Application is to be made by the Council to the B. of T. for a prov. order to supply electrical energy for public and private purposes within the district. It is understood that the Council will transfer the order to the Bettwsycoed Electric Lighting Syndicate, who propose to generate electricity by water-power.

Birmingham.—The Corporation has recently acquired an 8-h.p. motor-car from the Rover Co., Ltd., Coventry; it is to be used by the Corporation electrical department as an inspection coach.

Blackrock.—In regard to the movement to promote an E.L. syndicate, we gather that it is proposed to light Dalkey and Kingstown as well as Blackrock, and also operate a tramway in the district. A site at Stradbrook is suggested for the power station. The proposed tramway routes are from Blackrock to Foxrock and to Bray. The scheme is to be placed before the B. of T. with a view to an extension of time being obtained to carry out the U.D.C. prov. order of 1900.

Bray.—A Dublin paper states that overtures have been made to the U.D.C. with a view to purchasing its electricity undertaking.

Brierley Hill.—At a meeting of the U.D.C. on Monday it was decided to write the L.G.B., asking for power to retain the E.L. order for another 12 months, on the ground that the light railway for which the Council hoped to use the order particularly was still in a state of negotiation.

British East Africa.—Mr. Clement Hirtzel has secured a concession to supply electrical energy for lighting and power to the township of Nairobi and the district included within a radius of 15 miles. It is proposed to obtain the necessary power from waterfalls on the River Ruera, some 18 miles away, and to supply it at 2d. per unit for power, and 1s. 8d. per lamp per month for lighting. It is anticipated that it will take 12 months to install the plant; and Mr. Hirtzel will shortly leave England for the Protectorate in this connection.

Burgess Hill.—The E.L. installation of the Burgess Hill and District Electric Supply Co. was inaugurated a week or two ago. The generating plant consists of a 50-h.p. Stockport gas engine, driving a dynamo of 130 amperes capacity at 250 volts. A battery of 140 cells is installed, and the supply is on the overhead system.

Colne.—The T.C. has decided to apply to the L.G.B. for loans of £1,000 for wiring for the E.L., £1,500 for the hiring out of motors, and £2,800 for meters and mains extensions.

Continental Notes.—Italy.—A hydro-electric installation is planned at a cost of £720,000 for the production of 30,000 h.p., to be utilised in the Milan district; in addition, the water derived would serve for irrigation purposes. Requests have been made to the Minister of Public Works, or to the local authority, to utilise water power for the production of electric energy by individuals and firms, as follows: Messrs. E. Mende, A. Sprecher, and G. Taiani, from the river Tanagro, Salerno. The Société Piémontaise, from the Dora Baltea, St. Vincent Montjovet, for the manufacture of carbide of calcium. The company "L'electricità de Sondrio," from the torrent Mallero, for utilisation at Sondrio. Angelo Omodeo de Catane, from the river Simeto; including the construction of a reservoir above the Ponte dei Saraceni, Aderno, and a canal 13,860 metres long through Aderno, Biancavilla, and Paterno. Francois Ferretti, from the torrent Castellano, commune of Vallecastellana, including the construction of a 121-metre canal. The firms of Minoli Brothers, Boine and Pasquale, metallurgical works, Susa, from the Dora Riparia, Susa. Concessions have been granted by the authorities for the utilisation of water power, as indicated, to the following individuals or firms: Engineer Carotti, from the right bank of the Rio Peschiera. Pallanza, for the use of the Bros. Fighetti, millers, of Vignone; Achille Piatti, from the river Aniene, Subiaco, including a turbine installation for supplying electric energy to the Mandela-Subiaco railway, and for lighting Subiaco by electricity; Boccoli-Pietro, from the torrent Borsa, Maissana; Sr. de Michetti Vincenzo, from the river Tordino, Teramo.—*Board of Trade Journal.*

The Societa Forni Termoelettrici Stassano has been formed at Turin, for the purpose of erecting a thermo-electric furnace there of a capacity of 1,000 kw.

La Società Frinlano d'Elettricità has been formed in Udine with a capital of £80,000 to establish an electric lighting station in the town.

A concession has been granted for a plant to be put down to utilise the water power of the river Sessera at Coggiola in the generation of electrical energy for lighting and power purposes.

Germany.—An electricity works is to be erected at Oberlindhart, Lower Bavaria. The water power of the River Laber will be utilised in connection with the scheme.

Cotton Mills.—Electric driving in Lancashire cotton mills is increasing in favour. Contracts have lately been let for the building of a new mill at Prestolee, near Farnworth, for the Irwell Bank Spinning Co. It is to be completed by midsummer, and its 90,000 spindles will be driven by electricity. Altogether this company has mills running which aggregate 326,000 spindles.

The Kearsley Spinning Co. are to adopt electricity as the motive power in their new mills to be started at Farnworth next month.

Coventry.—Councillor Errington, vice-chairman of the E.L. Committee, and a member of the Gas Committee, moved at a recent meeting for a return to be prepared showing the cost of the present system of electric lighting of the principal streets, with the view of seeing if gas would not be more economical. The motion was agreed to.

The E.L. Committee has decided to recommend the City Council to apply to the L.G.B. for sanction to a loan of £35,000 for extensions at the electricity works.

Dublin.—In a report on the electricity supply undertaking and extension of supply to Clontarf, Mr. Ruddle, the city electrical engineer, estimates the capital expenditure for the Clontarf extension at £29,660; annual capital charges to be met on above, £2,236; net revenue from 60 public arc lamps £328; net revenue from private supply, say, 160,000 units, at 2d., £1,330—£1,658; deficit, £577. Until the private supply is taken up to the above extent the deficit will be greater.

Guildford.—The R.D.C. has approved of application being made by the Urban Electric Supply Co. to the B. of T. for a prov. order (Godalming E.L. Extension) to supply Godalming and Compton.

Hoddesdon.—The B. of T. has written to the U.D.C. stating that it will defer the question of revoking the E.L. order until the end of 1906.

India.—Calcutta.—A very elaborate and complete electric plant is to be installed at the Mint, Calcutta, the indent for the equipment having been placed by the Secretary of State for India.

According to the Calcutta *Englishman*, the Corporation of Calcutta will shortly be asked to consider a new agreement which the Government proposes to make with the Calcutta Electric Supply Corporation in abrogation of all previous licences. It is expected that the opportunity will not be allowed to slip of making better terms for the public.

Kurhurbaree.—It is intended to install an electric coal-cutting and lighting equipment at the Kurhurbaree Collieries of the East India Railways at a cost of Rs.143,000.

Lilloah.—Messrs. Johnson & Phillips, Ltd., have secured the contract for the supply of motors, transformers and the complete

Palermo, so that now Palermo can speak with Turin or Venice, that is to say, over a distance of about 1,700 miles.

ment, as before, will be under the control of Mr. N. D. Cameron.

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electrical equipment of the railway carriage and wagon shops at Lilloah.

Kashmir.—*Indian Engineering* says that the machinery for the new electric supply system is being made at San Francisco.

Leeds.—A report by Alderman Matheson, the Chairman of the E.L. Committee of the Leeds Corporation (issued at the end of last week), deals with the history, present position and prospects of the electricity undertaking of the borough. A considerable portion of the installation laid down by the original company (in 1892-3), he states, was out of date almost as soon as put down, though it was selected in accordance with the best practice of the time. "It will probably be deemed advisable within a few years to reconstruct the older portions of the present works, with a view to utilising the space to the best advantage, and so deferring the time when it will be necessary to erect new works to supplement or supplant the present ones, an event which will involve a very great expenditure and some initial diminution of economy." It would appear, he remarks, that the position of Leeds, with its capital expenditure of £85 14s. 5d. per KW., is more favourable than that of electric supply companies on the average, notwithstanding the onerous terms of purchase; but, as compared with other municipal electricity undertakings, the burden upon Leeds is excessive to the extent of £9 16s. 5d. per KW., or £113,332 in the aggregate; the apparent over-capitalisation being more than accounted for by the estimated premium on stock issued in payment for the undertaking. The Corporation paid the House-to-House Co. £200,000 for goodwill. This burden, it is stated, should be reduced, and so long as it exists, Mr. Matheson considers it undesirable to apply surpluses as profits in relief of the rates. If the capital charges per KW. were reduced to the average figure of other municipal undertakings, it would mean a reduction of ¼d. per unit in the average price at which electricity could be supplied; but this could not be effected while every surplus is directed to the relief of the rates.

Discussing the financial questions involved in the discarding of the old plant and the reconstruction of the works, the report says that Mr. Dickinson, the manager of the electric lighting department, roughly estimates the cost of his scheme at £230,000, towards which he anticipates a sum of £30,000 will be obtained by the sale of the discarded plant, leaving a net expense of £200,000. The capital liabilities, Mr. Matheson considers, exceed the value of the assets, and such liabilities are excessive in proportion to the capacity of the plant as compared with the average of other electric supply undertakings, and especially with municipal undertakings. This necessitates an unduly high scale of charges for energy, whilst at present there is no adequate provision for renewals. If the amount devoted to relief of rates, with interest, were refunded and no further sums withdrawn, the undertaking would probably be able to meet all claims upon it.

Mr. Matheson recommends that the reconstruction scheme be approved, and that the L.G.B. be asked to sanction the borrowing of £120,000, or such other sum as shall bear the same proportion to the total estimated cost as the increase of capacity in the reconstructed works bears to the total capacity. Other financial changes are advised, and it is urged that no further sums should be applied in relief of rates, in any event, until the renewals now contemplated are fully provided for, and the net liabilities on capital account are reduced to the average of other municipal electricity undertakings, after which the question might be reconsidered.

London.—Hampstead.—The B.C. has decided that in future the charges for energy for private arc lighting (with the exception of continuous-current arc lights), shall be 1½d. per unit for the two summer quarters, and 3½d. per unit for the two winter quarters, and that supply for such arcs shall not be included in determining the maximum demand.

Bermondsey.—Application is to be made to the L.C.C. for sanction to borrow £15,507 for electric lighting purposes (£13,500 for mains, £1,307 for machinery and £700 for meters).

Islington.—The B.C. has decided to extend arc lighting to 15 miles of streets at present lighted by 714 gas lamps. These are to be superseded by 245 flame arc lamps, at a cost of £21,011.

St. Pancras.—Electric radiators are to be fitted up in the Council Chamber as an experiment, and the B.C. has also decided to obtain a further loan of £1,965 for street lighting.

Longton.—From the end of March, consumers of energy are to have the option of a flat rate of 6d. per unit, less 5 per cent. discount.

Lynton.—The property owners and residents of Barbrook have petitioned the U.D.C. to take steps to have the E.L. mains for public and private lighting extended.

Mexico.—The chief electrician of the Vita Colorado Mining and Smelting Co. (Parral district) is visiting Pittsburg, for the purpose of selecting machinery for an electrical plant for the operation of the mines.

Ossett.—A L.G.B. inquiry was held in the town last week into an application of the Corporation to borrow £3,500 for E.L. purposes. The B. of T. recently threatened to revoke the Corporation's order, and in consequence it has decided to install a small plant to work in conjunction with the refuse destructor. The inspector raised the question of obtaining a bulk supply, and the electrical engineer (Mr. W. Emmott) remarked that there would not be much difference as regards cost to the Council. There was some opposition.

Plymouth.—A L.G.B. inquiry took place on the 28th ult. in regard to an application by the T.C. to borrow £3,000 for L.T. cable extensions.

South Africa.—Durban.—A new 800-KW. Belliss-E.C.C. alternator has arrived, and is being erected.

South America.—Chile.—The Tabolan Electric Co. has obtained a decree to supply San Francisco de Limache, and Limache, with electric light and power.—*Board of Trade Journal.*

Buenos Ayres.—The output of the German E.L. Co. for the year ended 1905, exclusive of tramway and public lighting, was 11,351,718 KW.-hours for lighting, and 4,655,792 KW.-hours for power.

Sunderland.—The T.C. has been recommended by the Electricity and Lighting Committee to reduce the price of energy for lighting, so that no consumer shall pay more than 3½d. per unit, and to lower the price of the tramways supply from 1¾d. to 1$\frac{1}{16}$d. per unit.

Wednesbury.—In regard to the present maximum demand system charged, *i.e.*, 6d. one hour and 2d. after, the Lighting Committee has decided to take the average of two readings of the indicator per quarter. No change is made in the flat rate of 4d. per unit, but the present maximum demand system for power purposes is to be discontinued, and a flat rate of 2d. introduced, with a reduction to 1½d. where energy is used regularly for 30 hours per week, throughout the quarter. The existing minimum charge for electricity of 10s. per quarter is to be retained in the case of power, but it is to be altered to 7s. 6d. in the summer, and 12s 6d. in winter, for lighting. The minimum charge, however, is not to be enforced in the case of prepayment meters.

Wellington.—A N.Z. paper says that the City Corporation will shortly undertake the lighting of the city, and has ordered new machinery to be installed at the power station for the purpose. The power station referred to is apparently that which at present supplies the tramways.

TRAMWAY and RAILWAY NOTES.

Australia.—The New South Wales Government Tramways last year (1904-5) carried 139 million passengers, ran 18 million car-miles, and earned £813,000. The number of cars amounts to 1,029, and 181 miles of track are operated.

Baker Street and Waterloo Railway.—On Wednesday last, the 7th inst., a Press inspection of the above line, followed by a luncheon at the Great Central Hotel, was held. To-morrow, the section of route lying between Baker Street and Kennington will be open for public traffic, while it is anticipated that the Elephant and Castle extension will follow in some four months, and the northern extension to Paddington in about 10 months. The eight stations which will presently be available, and which indicate the route, are at Kennington, Waterloo, Charing Cross, Trafalgar Square, Piccadilly Circus, Oxford Circus, Regent's Park and Baker Street; between them they afford intercommunication between the Great Central, Metropolitan, Central London and Brompton & Piccadilly Railways in the north, and the South-Eastern, District and South-Western Railways and the L.C.C. tramway system in the south. The tube does not differ materially from its predecessors; third and fourth insulated rails are provided, and energy for the operation of the line is obtained from the Lot's Road Power Station of the Underground Electric Railway Co., *viâ* the Charing Cross sub-station of the District Railway, while the automatic signalling system is similar to that employed on the latter. Six-coach trains, made almost entirely of steel, and supplied by the American Car and Foundry Co., with seating accommodation for 300 passengers, will be used on the route, over which a three-minute service will be given during the greater part of the day.

Barrhead.—The Paisley Tramway Co. has obtained the consent of the T.C. to complete the line in terms of the order to Cross Arthurlie Corner, provided the company agrees to give running powers over that section at any future date to Glasgow, in the event of the Glasgow line being extended to Barrhead and such running powers being then sought.

Brighouse.—The T.C. has decided to support the Bill of the West Yorkshire Tramways Co., which is seeking powers to construct electric tramways to connect Halifax and Huddersfield, *viâ* Elland, Rastrick and Brighouse.

Continental Notes.—Germany.—The Grand Berlin Tramway Co. has issued statistics in relation to its activity during 1905. It appears that the company, which has 313 miles of tramway in operation, carried 350½ millions of passengers last year, as compared with 332½ millions in 1904, the number of motor-cars and trailers being 2,433. The percentage of working expenses to gross receipts, which amounted to 55·33 per cent. in 1904, declined to 54·68 per cent. last year. The following are a few items of interest for the past two years:—

	1905.	1904.
Gross revenue	£1,714,000	£1,571,000
Total expenditure	£937,000	£869,000
Net profits	£464,600	£434,800
Dividend, per cent.	7¾	7½

The renewal fund has received from the available surplus the sum of £101,200, as compared with £86,250 in 1904. The share of the city of Berlin and the suburban authorities in the gross profits amounts to £120,200 for 1905, as contrasted with £113,300 in 1904, while the city of Berlin also receives, according to the existing agreement, £18,800 out of the net profits, as against £5,987 in 1904. The casualty list for the year is also worthy of prominence, as follows:—

Number of Accidents to Persons in 1905.

Slightly injured	1,527
Severely injured	159
Killed	18
Total	1,704

It is stated that out of the total casualty list no fewer than 16 persons were killed and 135 severely injured and 1,146 slightly injured owing to their own fault. The list includes all personal accidents, that is, to both passengers and pedestrians.

Russia.—An important tramway undertaking, estimated to cost in all two millions sterling, is projected for St. Petersburg. The scheme provides for the conversion of the existing horse tramways in the Nevsky Prospect and other important streets, comprising about 20 miles of route, to be followed later by 30 miles of new track. The contract has been placed by the municipality with the Russian Westinghouse Co.

Italy.—The Italian Electric Tramways Union has been authorised to construct and work an electric tramway in Genoa, between San Martino d'Albaro and Borgoratti.—*Board of Trade Journal.*

Switzerland.—An electric tramway is to be constructed from Versoix, in the direction of Divonne-les-Bains, to the Sauverny bridge on the French frontier. It will be a single line of 1 m. gauge and 5·2 km. in length; the estimated cost is £38,000, of which £7,900 will be for rolling stock.—*Board of Trade Journal.*

Darlaston.—The General Purposes Committee of the U.D.C. has had before it a communication from the B. of T. relative to an application by the South Staffordshire Tramways (Lessee) Co. for further consent to use electric traction on the part of the lines worked by the company in the Darlaston district. The General Purposes Committee has instructed the clerk to ask the B. of T. before acceding to the application of the company to cause an inspection of the lines and cars, which the Committee considers dangerous to the travelling public owing to their worn and faulty condition, as well as being a source of discomfort to passengers.

Glasgow.—It is reported that negotiations are in progress with a view to the electrification of the Glasgow cable subway.

The extension of the tramway system from Maryhill to Killermont will be ready for opening shortly. The extension from Barracknie to Baillieston was opened on Saturday.

Huddersfield.—On Saturday a car descending a steep incline on the Huddersfield Corporation tramways system, got beyond control at Newsome and left the metals. It ran into a horse and cart, and four passengers in the car, as well as the conductor, sustained severe shocks.

Kingston.—On Monday the 1st inst., the Kingston extensions of the London United Tramways were opened, the invited guests making a tour of the routes in three of the new double-deck top-covered bogie cars which have been provided for these routes, and being subsequently entertained to luncheon by the tramways company. The newly opened routes form a junction with the Hampton Court circular route at the north end of Kingston Bridge, extending over the latter and through the town up Kingston Hill; branches lead through Surbiton to Tolworth in one direction and to Ditton in another, while a further extension through Malden and Raynes Park to Wimbledon and Tooting is in course of construction. Messrs. J. G. White & Co. hold the contract for the whole of the Surrey tramway extensions.

Energy for the operation of the Kingston lines is obtained from the Lot's Road power station of the Underground Railways Co., being transmitted some 10 miles in the form of three-phase current at a pressure of 11,000 volts to the local sub-station at Kingston. The sub-station contains an equipment of Westinghouse transformers and rotaries for supplying the local tramway feeders. Messrs. W. T. Henley's Telegraph Works Co. were the contractors for all the cables.

At the luncheon held in celebration of the event, Mr. C. J. Cater Scott, chairman of the company, presided, amongst those present being Sir Thomas Skewes Cox, Sir J. Clifton Robinson, Sir James Szlumper, Mr. Edgar Speyer and numerous local representatives. Mr. Scott, in acknowledging the toast of "Success to the Tramways," mentioned that the company's route mileage had been extended that day from 37 to 44 miles, and when the Surrey extensions were completed the total mileage would be 55, and a connection would be given with the L.C.C. system at Tooting. In five years the company had run 29 million car-miles and carried 202 million passengers.

The opening, otherwise successful, was marred by a slight accident to Sir J. Clifton Robinson, due to a restive horse, attached to a brewer's dray, colliding with the leading car.

Liverpool.—The Tramways Committee some time ago gave attention to the subject of issuing return tickets by the electric tramway cars in the early hours of the morning at a single fare, the tickets to be available for return at any time through the day. After considering the project fully, the Committee arrived at the conclusion that the scheme, if adopted, would entail a considerable loss, and decided not to proceed with the scheme.

London.—L.C.C.—At the meeting on Tuesday the Highways Committee reminded the Council of the vote of £3,500 last July for the provision of electro-magnetic or other brakes for 60 cars, leaving for a time the question of similarly equipping the remaining 340 cars. The B. of T. had intimated that, subject to the cars being fitted with brakes as proposed, and to certain minor details being observed, they would increase the present maximum speeds, taking into account the nature of the traffic on the various sections of the tramways. The Committee stated that it had only recently been possible to obtain a thoroughly satisfactory form of electro-magnetic brake, but the experience gained from the cars equipped with the brakes now working fully justified the proposed extension of their use. It was intended to report at an early date as to the steps to be taken to procure the brakes, and in the meantime the Committee asked the Council to sanction an expenditure of £10,200 for the purpose.

Metropolitan Railway.—A breakdown took place on this line between Mark Lane and Monument stations on Friday last.

Metropolitan District Railway.—An electric train broke down at Mansion House station on Thursday last week, causing an hour's delay. On Sunday an electric train entered Wimbledon terminus at too high a speed, and crashed into the booking office, and on the same day an axle broke on an Ealing train at West Kensington, causing several hours' delay. The accelerated service came into force on the 1st inst.

Manchester.—A company is on the point of being formed with, it is said, a capital of £300,000, to provide a service of motor-omnibuses to serve the districts within a radius of 20 or 30 miles, and to bring them into closer communication with Manchester as a centre. As an earnest of the promoters' intention, two omnibuses have already begun to ply between Hale (Altrincham) and Flixton, *viâ* Stretford, and the builders have contracted to deliver 40 more during the next two months. When the vehicles are ready, daily services will be started between Manchester and such outlying towns as Chester, Knutsford, Wigan, Buxton and Warrington. Each omnibus has a dead weight of over 4 tons; the engines are of 30-34 h.p., and are strong enough to take it up an incline of 1 in 10 with a full load of passengers. Not the least important fact, and one that has occasioned much surprise, is that Mr. Daniel Boyle, who has served the Manchester citizens with conspicuous ability as chairman of the Tramways Committee ever since the tramways were municipalised, has accepted the managing directorship of the new company. He does not, however, resign his seat on the Manchester City Council.

Mr. Boyle has made it clear that the new motor-omnibus service is not to compete with the Manchester tramways. It will, on the contrary, act as a feeder by linking up the various outlying districts not yet adequately served with the Manchester system. It is understood that Mr. Alderman Wainwright, who has been vice-chairman of the Tramways Committee since its formation, will succeed to the chairmanship.

Trouble is threatened between the Manchester Corporation Tramway Department and its employés on the question of extra pay for Sunday labour. The men held a midnight meeting on Saturday to press their demand. They offered to submit the matter to arbitration, and, failing an agreement on the part of the Tramways Committee to accede to this, a ballot will be taken on the question of withdrawing their labour, to enforce what they consider their rights.

The Tramway sub-Committee of the Manchester Corporation has had the matter under consideration, and a substantial concession is recommended to the men. It is proposed that time and quarter should be paid for any work after the 9-hour day had been completed. The drivers now receive 7d. per hour, and the conductors 6¾d.

New Zealand.—Christchurch.—The Tramway Board has agreed to a suggestion of the Executive Commissioners of the New Zealand International Exhibition to put down a temporary track to the Exhibition grounds at an estimated cost of £1,700. At the end of the term the Commissioners agree to provide the total cost, the Board taking over the new material necessary at valuation.

Wellington.—During the 12 months ended on December 31st last the city tramways carried 12,764,238 passengers.

Auckland.—During 1905 the number of passengers carried by the Electric Tramways Co. was nearly 20 millions, an increase of a million and a quarter over 1904. Surveys are being carried out in connection with some proposed extensions to the company's system.

Devonport.—The B.C. has been asked to assent to the construction of a system of electric tramways within its district, and has decided that, if the promoter deposits £500 for the option to construct a system, the Council will be prepared to consider proposals as to the terms of option.

South Africa.—Johannesburg.—Messrs. Mordey and Dawbarn have submitted their report in connection with stages and fares, and the Tramway and Lighting Committee recommends 1d. stages, but in the first instance a minimum fare of 2d. will be introduced. As copper coinage is of a very limited nature in Johannesburg, the use of coupons is advocated.

The section of the new electric tramway service as far as Doornfontein has been completed. It was intended to commence a 10-minute service on the 14th ult.

Durban.—The receipts of the municipal tramways for the month of January last amounted to £7,505, an increase of £489 over January of 1904. The miles run amounted to 103,343.

Saltcoats.—At a meeting of the inhabitants a resolution in favour of the North Ayrshire tramway scheme was passed.

West Kilbride.—A meeting of ratepayers has decided against the proposed tramways from Stevenston to Portencross so far as the Ardrossan and Portencross part is concerned.

Willesden.—At the meeting on Tuesday of the U.D.C., a letter was read from the L.C.C., asking if consent would be given to the introduction of the L.C.C. (Tramways and Improvements) Bill, upon an undertaking being given that Tramway No. 1 would be withdrawn if an agreement could not be arrived at with the Hampstead and Willesden Councils in connection therewith. A further conference of the two local authorities is to be held to consider the proposals of the L.C.C. and the Middlesex County Council.

TELEGRAPH and TELEPHONE NOTES.

Birmingham.—The National Telephone Co. has found it necessary, owing to the rapid growth of the business, to commence the erection of a large new exchange, which is to be ready in 12 months.

Canada.—The *Standard* Ottawa correspondent states that the Marine Department will build three Marconi stations on the Pacific Coast. The recent steamship Valencia disaster off Vancouver, by which over 100 persons perished, has induced the Government to take this action.

The Bell Telephone Co., of Canada, is proposing to increase its capital from two to ten millions sterling. The total number of stations connected with its system is 78,195, with 526 exchanges and 959 agencies. The long-distance lines owned by the company now amount to 37,082 miles of wire, on 8,645 miles of poles. The net revenue amounted to over £180,000, of which £130,000 was paid in dividends.

According to the *Montreal Witness* even a mild winter has its drawbacks, and its very mildness may become a source of much trouble to telegraph and telephone companies:—

"The fact was strikingly illustrated the other day by the loss of the Bell Telephone Co.'s submarine cable, which was laid across the bed of the St. Lawrence between Three Rivers and Doucet's Landing last fall—the second break in two months. For the river to remain open at this point is a thing which the experience of the traditional 'oldest inhabitant' cannot duplicate; but this year the surface ice has steadily refused to form. Not so, however, the anchor ice, deep down in the stream. When the company's cable snapped last month it was found to be floating near the surface crusted with anchor ice, until it was the diameter of a flour barrel, the immense incrustation of ice finally becoming lighter than the water, which raised the cable from its river bed and caused the conducting wires to break asunder. Without the protection which surface ice would have furnished, this anchor ice has been slowly forming since the beginning of winter, and the swift current rushing against this barrier and depositing thereon fine needle-like icicles, had proved too much for the cable. Had the river frozen in due season, as it generally does, the cable would have been safe."

In 1882 the Bell Co. laid its first cable between Quebec and Levis to provide people in the latter place with telephone connection with the Quebec exchange. This cable has been broken on an average twice every year since that time. In addition to this trouble, the wear upon cables caused by the tide and current has made it necessary to renew them entirely no less than four times.

China.—The Great Northern Telegraph Co. announces that the Chinese Government officially advises the re-opening of telegraph offices at Newchwang and Mukden in the province of Shinking.

Glasgow.—The Corporation expended £690 in connection with the opposition to the agreement for the purchase by the Government of the National Telephone Co.'s undertaking. Now alleging that its action was taken in the interests of the general community, the Corporation has resolved to pay this sum, not out of the Telephone Department's funds, but out of the Common Good.

Newfoundland.—Opening the Newfoundland Legislature, the Governor announced the conclusion of an agreement with the Marconi Telegram Co. to operate a wireless system along the Labrador coast, which would be connected with the postal telegraphic service of the Colony. The agreement also stipulated that all ocean messages received by the Marconi stations on the island should be forwarded to their destination over the Government cable, which connects with the Commercial Co.'s cables at Canso, Nova Scotia.

South Africa.—Durban.—The T.C. is working out a scheme for cheap telephonic communication for householders. The proposal is to charge £3 10s. per annum for each instrument installed, and ½d. for each message.

Cape Colony.—The telegraph revenue of the Colony during December amounted to £15,535, bringing the revenue for the year 1905 to £206,674, this being a decrease of £4,488, compared with the revenue for 1904.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	..
Dominica-Martinique	May 7, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	..
Cayenne-Pinheiro	Aug. 13, 1902	..
Port Arthur-Chifu (Closed)	Mar. 7, 1904	..
Jamaica-Colon	Jan. 5, 1905	..
Cadiz-Tenerif	July 20, 1905	..
Tarifa-Tangier	Jan. 18, 1904	..
Puerto Plata-Martinique	Oct. 30, 1905	..
Panama-Buenaventura	Feb. 1, 1906	Feb. 27.
Buenaventura-St. Elena	Feb. 1, 1906	Feb. 27.
St. Vincent-Grenada	Feb. 16, 1906	..
St. Vincent-St. Lucia	Feb. 16, 1906	..
Tangier-Cadiz	Feb. 18, 1906	..
Grenada-Trinidad	Feb. 22, 1906	..
S. Juan-St. Thomas	Feb. 24, 1906	Mar. 6.
Ponce-St. Croix	Feb. 24, 1906	Mar. 6.
Alexandrie-Larnaca	Feb. 28, 1906	..
Guadeloupe-Dominica	Mar. 4, 1906	Mar. 6.
Landlines.		
Puerto-Barrios	Aug. 28, 1902	..
Communication with Brazil *via* Galveston	July 18, 1905	..
Bachkale-Deliman	Feb. 12, 1906	..

Wireless Telegraphy.—It would appear from particulars forwarded by a correspondent at Amsterdam that the German Wireless Telegraph Co., which owns the "Telefunken" system, is gaining an advantage over the Marconi Co. in the Dutch Indies. At the end of 1904 the Dutch Parliament rejected a proposal to make a State monopoly of wireless telegraphy, and granted a concession to the English company in regard to the Netherland Indies, but apparently nothing has been done to give effect to it. In the meantime the Germans have stepped in and made progress. According to a reply recently given by the Naval Minister, Cohen-Stuart, in answer to a question put by Deputy Jansen in the Dutch Parliament, the Telefunken system has been adopted on the Dutch ships, and has proved satisfactory. The general governor of the Dutch Indies in March, 1905, gave permission to the German company to establish two stations at Batavia and Cheribon, and both stations were in full operation last December. As to the inactivity of the Marconi Co., the Utrecht *Dagblad* states that the company will only proceed with the formation of a separate company for the Indies when the Government has guaranteed an annual subsidy of £8,333 at the beginning, and £6,250 per annum subsequently. The newspaper expresses the hope that State money will not be placed at disposal or guaranteed "for this advantage of a highly questionable nature"—that of belonging to the English world telegraph network. This is considered to be all the less necessary, as wireless telegraphy has been brought into existence in the Indies without the support of the Government, and working on the same system with which the Dutch ships are equipped. We wonder whether the Dutch paper is edited or owned by a German.

The Postmaster-General of New South Wales, Mr. A. Chapman, has had a number of interviews with Mr. Hamilton (representative of the International Wireless Telegraph Co.), and Captain Walker, who represents the Marconi Co., both of whom are endeavouring to establish their respective systems in Australia and New Zealand. It is understood that Mr. Chapman will allow both companies to install experimental plants, with a view to making comparisons.

The Postmaster-General has agreed to limit the duration of the Wireless Telegraphy Bill to the end of 1912.

CONTRACTS OPEN and CLOSED.

OPEN.

Antwerp.—March 19th. The British Consul-General has forwarded to the Commercial Intelligence Branch of the Board of Trade particulars of a notice, issued by the Municipal Authorities, inviting tenders for the installation of electric light in the new Flemish theatre. The specification ("Cahier des Charges") relating to the contract may be obtained from the Hôtel de Ville, Antwerp. All tenders should be sent in sealed registered envelopes, addressed to the Collège des Bourgmestre et Echévins de la ville d'Anvers, and should reach the Hôtel de Ville not later than March 19th. A deposit of 7,000 francs (£280) is required to qualify any tender. A copy of the specification may be seen at the offices of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Barnes.—March 12th. Water-tube boiler, condenser, pump and pipe-work, for the U.D.C. See "Official Notices" February 23rd.

Belfast.—March 19th. One 400-kw. steam dynamo for the Corporation. See "Official Notices" March 2nd.

Bilston.—March 12th. Electric lighting of the new schools now being erected at Stonefield. See "Official Notices" February 9th.

Bolton.—March 29th. Materials and stores for the electricity department; also one continuous current electric generator and one steam engine. See "Official Notices" to-day.

Briton Ferry.—March 26th. Sub-station switchboard, feeder and distributor cables, feeder pillars, joint boxes, arc lamps and standards, for the U.D.C. See "Official Notices" March 2nd.

Chester.—March 31st. Construction and electrical equipment of tramways (permanent way, bonds, and overhead equipment) for the Corporation. See "Official Notices" to-day.

Dublin.—March 9th. Arc lamp carbons for the Corporation electricity department. See "Official Notices" March 2nd.

Edinburgh.—March 12th. Carbons, pavement boxes, meters, service fuse boxes and bitumen, for the Corporation. See "Official Notices" February 23rd.

Egypt.—April 30th. Tenders for the supply and erection of an electric light installation on board H.H.S. *Aida* at Alexandria. The plant is to consist of a suitable engine coupled direct to a 5½-KW. dynamo, including switchboard, instruments, wiring, lamps, switches, fuses and ventilators. Conditions of tender and specifications may be seen on application at the Central Office of the Ports and Lighthouses Administration, Cairo.—*Board of Trade Journal.*

Erith.—March 12th. Stores for the electricity works. See "Official Notices" February 23rd.

Fulham.—March 14th. General and electrical stores for the B.C. See "Official Notices" March 2nd.

Gillingham.—March 26th. Coal and meters for the electricity department. See "Official Notices" March 2nd.

Greenock.—March 15th. Two D.C. steam dynamos of 750-KW. each; one 500-KW. D.C. motor-generator for the Corporation. See "Official Notices" March 2nd.

Huddersfield.—March 9th. Vertical engine and piping; 750-KW. traction generator; switchboard and cable extensions, for the Tramways Committee. See "Official Notices" February 23rd.

Johannesburg.—March 31st. 350 street lamp fittings, 50 stays for ditto, and 600 ft. gas barrel for the T.C. See "Official Notices" February 16th.

Leeds.—April 9th. Steam turbine, two-phase alternator and exciter (3,000 KW.), condensing plant and piping, for the electric lighting department. See "Official Notices" February 23rd.

L.C.C.—March 20th. Seven electrically-operated car traversers. See "Official Notices" March 2nd.

L.C.C.—March 26th. Lighting and power installation for the Long Grove Asylum, Epsom, now erecting. See "Official Notices" February 23rd.

L.C.C.—March 27th. High and low tension switchgear for certain sub-stations. See "Official Notices" to-day.

Luton.—March 17th. Cables for the Corporation. See "Official Notices" to-day.

Norwich.—March 19th. Wires, cables and lamps for the Electricity Department. See "Official Notices" to-day.

Paris.—Two or three of the principal Paris tramway companies have decided to contract for the purchase of power from a large power station, which will shortly be erected in the south-east of Paris. The Compagnie Générale de Distribution d'Energie Electrique is the name of the company undertaking the construction of the station, in conjunction with the Compagnie des Grands Travaux de Marseilles. We understand that the power station will be laid out on generous lines in view of future increase in output. At the present moment it is contemplated installing two Curtis turbo groups of 5,000 KW., wound for a tension of 13,200 volts, 25 cycles. These groups will be supplemented by a smaller turbine for lighter loads. The total output of the station, when completed, will probably be over 50,000 kilowatts. The Compagnie Française Thomson-Houston will supply the electrical machinery required in this installation. The various other accessories, including all material required for such an installation, apart from electrical machinery and steam turbines, will be purchased from outside manufacturers. Offers and requests for information may be addressed to the Compagnie Française Thomson-Houston, 10, Rue de Londres, Paris, or to the Compagnie Générale de Distribution d'Energie Electrique, 12, Rue de Londres, Paris. We understand that the power station will be rapidly erected, and is expected to be in service within the next 18 months.

Spain.—March 19th. The municipal authorities of Villa Vieja (province of Salamanca) are inviting tenders until the 19th inst. for the concession for the electric lighting of the town. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Villa Vieja (Salamanca).

Sunderland.—March 28th. Stores, also ticket punches, for the tramways department. See "Official Notices" to-day.

Sunderland.—March 30th. One 750-KW. three-phase steam alternator, one 300-KW. static transformer, and two portable air compressors for the electricity department. See "Official Notices" to-day.

Swindon.—March 12th. Various materials for the electricity and tramways department. See "Official Notices" February 23rd.

Sydney (N.S.W.).—May 7th. Boilers, stokers, pipework, turbo-alternator, sub-station machinery, switchboards, &c., for the Council. See "Official Notices" February 9th.

Warrington.—March 13th. High and low tension cables for the Corporation. See "Official Notices" March 2nd.

West Bromwich.—March 19th. One 400-KW. turbo-generator; exhaust pipes. See "Official Notices" to-day.

Willesden.—March 22nd. 66 flame arc lamps for public street lighting for the U.D.C. See "Official Notices" to-day.

Wrexham.—March 23rd. Supplies for the Council's electricity department. See "Official Notices" to-day.

CLOSED.

Clydebank.—The Trustees of the Clyde Navigation have accepted the following offers for electric capstans and turntables required for Clydebank Dock:—

Messrs. Stothert & Pitt, six ordinary capstans.
Messrs. Clarke, Chapman & Co. for two large pier bend capstans.
Messrs. Cowans, Sheldon & Co. for two turntables.

The Workshops Committee of the Trust have, on the representation of the electrical engineer, authorised tenders to be taken from Messrs. Siemens Bros. and Messrs. Kelvin & James White, for the main switchboard for Clydebank Dock.

Messrs. Harris & Anderson have received an order for the water purifying plant for the Dock, and Messrs. Nagel & Kemp for the recording instrument.

The British Insulated & Helsby Cables, Ltd., have received the contract for the electric cables and conductors required for the Dock. The tender was the lowest.

Derby.—The T.C. has accepted the tender of Messrs. Milnes, Voss & Co. for the supply of four single-deck tramcars, at £2,232.

Dover.—The T.C. has accepted the tender of the British Westinghouse Co. for a steam-driven generator for the electricity works, at £1,753.

Exeter.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for the supply of six additional tramcars.

Lancaster.—The T.C. has accepted the tender of Mr. R. P. Wilson for installing the electric light in the Greave Schools, at £169 10s.

Leyton.—The U.D.C. has received the following tenders for tramway feeders:—

Western Electric Co.	£18,122 11
Henley's Telegraph Works, Ltd.	18,067 6
Johnson & Phillips	17,885 14
Siemens Bros. & Co.	17,709 16
Glover & Co.	17,613 9
British Insulated & Helsby Cables, Ltd. ..	17,587 1
Callender's Cable & Construction Co. ..	17,241 12

The tender of the British Electrical Equipment Co., Ltd., for the overhead electrical equipment of the tramways, has been accepted at £11,404.

London.—Hackney.—The B.C. has accepted the tender of Mr. H. Tuchman for the supply of 10-ampere arc lamp carbons, at £3 2s. per 1,000 pairs, and 7-ampere arc lamp carbons, at £2 8s. per 1,000 pairs. There were 13 tenders.

L.C.C.—At Tuesday's meeting the question of obtaining 150 cars for the first section of the northern tramways was referred to by the Highways Committee. A few months ago tenders were accepted for 150 additional cars for the southern tramways. The contracts respectively are as follows:—(1) Hurst, Nelson & Co., £63,525, for 150 roof-covered car-bodies; (2) Mountain & Gibson, £18,000, for the trucks of the cars; and (3) the British Westinghouse Co., £43,300, for the electrical equipments and the assembly of the cars, including the supply of electro-magnetic brakes. The total contract prices for these 150 cars amount to £124,825, or about £832 3s. 4d. a car, and the Committee had considered the question of extending the contracts so as to include the supply of the 150 cars now required for the northern tramways. The contractors in each case would be prepared to undertake the further work required. In the case of the contracts for car-bodies and trucks the contractors offered to undertake the work at the same rates and on the same conditions as under the existing contracts, but in the case of the contract for electrical equipments, &c., the British Westinghouse Co. would be prepared to supply the electro-magnetic brakes at the rate of £56 10s. a car, instead of £57 as under the existing contract. Moreover, the contractors were

willing to undertake to deliver all the cars by the time when first required for the electrical working of the Northern Tramways. Careful inquiries had been made with a view to ascertaining whether the Council's interests would be better served by obtaining new tenders for the 150 cars than by extending the present contracts, but the Committee did not think that any advantage would be gained by the adoption of the former course, and they, therefore, proposed the extension of the contracts in the way already indicated.

County of London.—We are informed that owing to the highly satisfactory showing made during the test of the first 1,500-kw. Curtis steam turbine installed at their Wandsworth and City Road stations, the County of London Electric Supply Co. have placed orders with the British Thomson-Houston Co., of Rugby, for three additional generators, each of the same capacity.

Camberwell.—The B.C. accepted on Wednesday the following tenders:—

Annual supply of incandescent electric lamps, General Electric Co., Robertson make, 100 or 200 volts, 8-c.p., 8s. 6d. per dozen, 16-c.p., 8s. 6d. per dozen, 32-c.p., 11s. per dozen; frosted, 9s. 6d., 9s. 6d. and 12s.

Maintenance of private telephones and electric bells at Town Hall and Grove Vale Depôt, Electrical Engineering and Maintenance Co.

Pontypridd.—The U.D.C. Electricity Committee received estimates for the eight additional cars, and the engineer recommended the acceptance, subject to further inquiries, of the tender of the British Thomson-Houston Co., as follows:—

Milnes-Voss bodies, at £256	£2,048
Mountain & Gibson trucks, at £100 each	800
B.T.H. electrical equipments, at £219 5s. each	1,754
B.T.H. track brakes, at £50 each	400
Car spares, £418 8s. 3d., less £184	234
Provisional sum	50
	£5,286
If Brush bodies instead of Milnes-Voss, add..	100
Making a total of	£5,446
Price per car, first tender, £5,286 8s. 3d., divided by eight ..	£660 16
Price per car, second tender, £5,446 8s. 3d., divided by eight ..	680 16

It was decided that the manager should inspect Messrs. Milnes, Voss & Co.'s works and car bodies turned out by them, and report to a special meeting. The new cars are to be provided with forged steel side frames.

Wemyss.—The contract for rolling stock, overhead equipment and cables (nine miles), for the above tramways has been placed with Messrs. Bruce Peebles & Co., Ltd.

Wimbledon.—The T.C. has accepted the following tenders:—

General Electric Co., Ltd., supply and erection of air compressing plant at the pumping station, £701.

Stanton Ironworks Co., Ltd., supply and delivery of cast-iron pipes required in connection with electricity works' extensions, £483.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, March 12th.—"A" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.; N. C. O.'s class, 9 p.m.

Tuesday, March 13th.—"B" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.; medical examination recruits, 7 p.m.

Wednesday, March 14th.—"A" badge examination for "C" and "D" Companies.

Thursday, March 15th.—"C" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.

Friday, March 16th.—"D" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.

Saturday, March 17th.—Week-end instruction for "A" Company (country members). "D" company, night run at Gravesend.

J. H. S. Phillips, Captain E.E.

For O.C.E.E.R.E. (V.).

Helios Lamps.—Messrs. J. Defries & Sons, Ltd., write to state that in consequence of the decision of Mr. Justice Joyce, reported on another page, the original enclosed arc lamps manufactured for, and during the existence of, the Stewart Electrical Syndicate, Ltd., by the Helios Manufacturing Co., and then sold in England as "Stewart Enclosed Arc Lamps," will henceforth be known as Helios enclosed arc lamps. The change will be solely one of name, and no alterations will be made in the construction of the lamps or of any of their repair or spare parts.

Electric Shock Fatality.—An evening contemporary says that a student at the Electric Engineering Union College, New York, while assisting in an experiment in the laboratory before the class, accidentally received a 2,300-volt shock, and was killed.

Cooper "Anchor" Joint Case: Judgment.—On Thursday, Mr. Justice Swinfen Eady delivered his reserved judgment. He held that the action failed, and must be dismissed with costs. A full report of the judgment will appear next week.

FORTHCOMING EVENTS.

To-day's Events (Friday, March 9th).—At 7.30 p.m. I.E.E. (Manchester Students). At Royal Technical Institute, Salford. Messrs. E. Müller and J. Davies on "Modern Primary Batteries."

At 8 p.m. Physical Society. Dr. Harker on "Some Experiments on Earth-currents at Kew Observatory."

Saturday, March 10th.—At 10 a.m. I.E.E. (Students). Visit to Messrs. Elliott Bros.' Works, Lewisham.

At 3 p.m. Royal Institution. Prof. J. J. Thomson on "The Corpuscular Theory of Matter." (Lecture II.)

At 7 p.m. Junior Institution of Engineers. Reception at Westminster Palace Hotel.

At 7.30 p.m. Birmingham and District Electric Club. Colonnade Hotel. Mr. R. G. Mercer on "Electricity in Mines."

Monday, March 12th.—At 8 p.m. Society of Arts. Cantor Lecture by Prof. V. B. Lewes on "Fire, Fire Risks and Fire Extinction" (Lecture I.).

Inst. of M.E. Mr. J. H. Hurst on "Notes on the Design and Construction of Large Gas Engines."

Tuesday, March 13th.—At 7.30 p.m. I.E.E. (Manchester). Mr. J. R. Salter on "Economic Considerations in the Employment of Storage Batteries."

At 8 p.m. I.E.E. (Glasgow). Prof. F. Soddy on "The Internal Energy of Elements."

At 8 p.m. I.C.E. Mr. J. J. Webster on "The Widnes and Runcorn Transporter Bridge."

Wednesday, March 14th.—At 7.30 p.m. I.E.E. (Birmingham). Meeting at Technical School, Suffolk Street. Dr. W. E. Sumpner on "New Iron-Cored Instruments for Alternate Current Working." Discussion and Experimental Demonstration.

At 7.30 p.m. I.E.E. (Students). Messrs. F. C. Prentice and J. S. Westerdale on "The Efficiency of Lamp Globes."

At 8 p.m. Association of Engineers-in-Charge. Mr. G. Bibby on "Ventilation of Public Buildings."

Thursday, March 15th.—Rugby Engineering Society. Mr. L. M. Gledhill on "High Speed Steel."

At 8.30 p.m. Chemical Society meeting.

Friday, March 16th.—At 8 p.m. I.M.E. Adjourned discussion on "Large Locomotive Boilers," and paper on "Petroleum Fuel in Locomotives," by Mr. L. Greaven.

At 9 p.m. Royal Institution. Mr. W. Duddell on "How to Improve Telephony."

I.E.E. (Students). Visit to the B. of T. Electrical Laboratory.

N.E. Coast Institution of Engineers and Shipbuilders. Meeting.

Saturday, March 17th.—At 3 p.m. Royal Institution. Prof. J. J. Thomson on "The Corpuscular Theory of Matter." (Lecture III.)

At 7.30 p.m. Glasgow and West of Scotland Technical College. Mr. J. Murdoch on "Metals Used for Bearings of Shafting and Lubrication of Same."

NOTES.

Canals and Waterways.—The King has been pleased to appoint a Royal Commission to inquire into the canals and inland navigation of the United Kingdom and to report on:—

1. Their present condition and financial position.

2. The causes which have operated to prevent the carrying out of improvements by private enterprise, and whether such causes are removable by legislation.

3. Facilities, improvements and extensions desirable in order to complete a system of through communication by water between centres of commercial, industrial, or agricultural importance, and between such centres and the sea.

4. The prospect of benefit to the trade of the country compatible with a reasonable return on the probable cost.

5. The expediency of canals being made or acquired by public bodies or trusts, and the methods by which funds for the purpose could be obtained and secured, and what should be the system of control and management of such bodies or trusts.

The following are the Royal Commissioners:—

Lord Shuttleworth, chairman.
Lord Kenyon.
Lord Brassey.
Lord Farrer.
Sir John Dorington.
Sir John Brunner, M.P.
Sir Francis Hopwood (Permanent Secretary to the Board of Trade).
W. J. Crossley, M.P.
Russell Rea, M.P.
J. F. Remnant, M.P.
P. Snowdon, M.P.
Henry Vivian, M.P.
L. A. Waldron, M.P.
R. C. H. Davison, C.E.
J. P. Griffith, C.E.
Dr. A. J. Herbertson.
J. C. Inglis, C.E.
H. F. Killick.
John Wilson.

W. B. Duffield, barrister-at-law, will act as secretary.

An Engineering Exhibition at Olympia.—Arrangements are in progress for holding an "Engineering and Machinery Exhibition" at Olympia from September 15th to October 17th next inclusive. Sir W. H. White is the president. Messrs. G. D. Smith and F. W. Bridges are the organising managers, and it will be remembered that they acted in a similar capacity for the recent electrical exhibition at Olympia. Mr. G. T. Harrap is the consulting engineer. A preliminary prospectus is in circulation, which announces a list of distinguished patrons, including presidents of the various engineering institutions, amongst whom is Mr. John Gavey, C.B., as representing the Institution of Electrical Engineers. There is also a provisional honorary advisory committee representing various departments of the engineering industry and science. Among the proposed sections are the following:—Mining machinery and appliances; gas, steam and oil engines; power transmission;

railway and tramway work; road locomotion; electrical appliances, power and light, telegraph and telephone; machine stoking and labour-saving appliances. In these departments, and doubtless in pretty well all the others also, the Exhibition must be of great interest electrically.

Leicester Corporation Tramways Ambulance Division.—Under the presidency of the chief engineer, Mr. T. R. Smith, the ambulance class formed by the employés of the Tramways Department has made such rapid strides that their application to the St. John Ambulance Association to form a separate division has been granted, and the members met on 26th ult. at the recreation room to celebrate their success. The chair was occupied by the chairman of the Tramways Committee, Councillor S. Flint, J.P. Certificates to 12 successful members at a recent examination were presented by the chairman, who, in congratulating the division, stated that the Tramways Committee would be pleased at all times to meet the men in regard to re-arranging their shifts in order to permit them to perform their ambulance duties when necessary. The chief engineer complimented the members of his class on their success, and stated that already 20 serious accidents had been dealt with and first aid rendered since the formation of the class last June, and though the division was only in its infancy, there were 31 members on the books all capable of rendering first aid. The following is the full list of officers of the new Tramways Division:—Honorary surgeon, Dr. F. Lewitt; acting first officer, Inspector A. Palmer; sergeant, Motorman C. Burrows; corporal and inspector of stores, Inspector F. Aubrey; hon. treasurer, E. J. Riley; hon. secretary, H. H. Warner; and chairman of committee, Mr. T. R. Smith.

Another Electro-Medical Quackery Case.—At the Wolverhampton Police Court on March 1st, Albert Edward Richard, who, under the title "Professor Richard, M.E.," has been giving demonstrations in the Drill Hall there concerning the "marvels of medical scientific electricity," as a local paper calls them, was charged with obtaining 15' guineas from Robert McKecknie, by means of false pretences with intent to defraud. For the prosecution it was stated that there were charges against the prisoner from all parts of the country. In Wolverhampton there were 41 cases, prisoner having received £600 or £700 from poor deluded victims in about three weeks. The prosecutor in this case was promised by Richard that for 15 guineas he would cure him of blindness in four months—one of the payments being eight guineas and the other seven guineas for a battery and coil. It was contended for the defence that the wording of the receipt for the money contained no guarantee to cure. The money was paid on February 7th, and plaintiff had Richard arrested on February 28th (before the four months had expired) because he was going away. For the defence also it was said that prisoner had been carrying on his business for many years, and *Truth* had said something about him, but if there had been anything of a suspicious nature Scotland Yard would have taken up the matter. The Bench remanded prisoner for a week, bail being allowed in one surety of £500 and two of £250 each.

A Telegraph Dance.—A promenade concert and dance is to be given at the Holborn Town Hall on March 21st in aid of the funds for the Central Telegraph Office Library.

Appointments Vacant.—Draughtsman for the electrical department at H.M. Dockyard, Devonport (39s.); assistant engineer for the Cornwall County Asylum, Bodmin; resident electrical superintendent (£300), assistant rolling stock superintendent (£250), and three charge engineers (£250), for the London County Council; engineer for the Youghal Auxiliary Asylum; assistant engineer for Hammersmith (£3); chief lecturer in electrical engineering at the Croydon Polytechnic; sub-station assistant for Stoke Newington.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting of the Birmingham Local Section on February 14th, Dr. W. E. Sumpner announced the resignation of Prof. R. Threlfall as chairman. He said that Prof. Threlfall found himself unable to continue the chairmanship for several reasons, among which was the fact that he was shortly proceeding to America, where he would be staying for some time. In view of the large amount of work which must fall to the chairman in connection with the forthcoming visit of foreign electrical engineers, Prof. Threlfall felt that the interests of the Local Section would best be served by his resigning, and the Committee had acceded to his wishes. Mr. J. C. Vaudrey, past chairman, had been elected, and had accepted the office for the remainder of the session.

The annual dinner of the Manchester Local Section took place last week. Our report is held over.

Röntgen Society.—In the February issue of the *Journal* of this society, the address of the President, Mr. Frederick Soddy, is printed in full. In this the President gave a rapid but comprehensive review of "The Present Position of Radio-Activity," illustrating his lecture with experiments. The intense interest with which the subject is charged is rivalled by the skill with which it is handled in this lecture, and being unable to reprint it, we strongly recommend the original to our readers.

Glasgow Technical College Scientific Society.—On Saturday Mr. Andrew Stewart, A.M.I.E.E., read a paper on "Portable Electric Tools and their Industrial Applications." He briefly outlined the early developments of such tools abroad, and particularly the pioneer work of Mr. F. J. Rowan, who some 24 years ago set electric tools to work in some of the French shipyards, as well as in the shipyards of Messrs. McMillan and Messrs. Denny, on the Clyde. Proceeding to deal with the difficulties and limitations which portability and efficiency imposed on the designer, Mr. Stewart referred to the methods adopted to overcome these, and gave examples of alternative designs to secure high average efficiency and reliability, for the absence of the latter feature had, in several cases, been conspicuous, especially in the case of small, light-weight tools. Examples of various electric tools applied to drilling, grinding and milling were shown, and magnetic drilling posts of various types for holding electric drills on bridges, ships' decks and similar work, were exhibited in operation.

British Motor-Boat Club.—On Wednesday, March 14th, a paper written by Mr. G. de Holden Stone on "The Requirements of Marine Motors in Design and Construction" will be read at the headquarters of the British Motor-Boat Club, Craven Hotel, Charing Cross. The usual house dinner will be held previously, at seven o'clock.

Society of Arts.—On Wednesday last week, Capt. G. S. C. Swinton delivered an address on the subject of London traffic, Sir J. Wolfe-Barry presiding.

Electrical Engineers R.E.V.—A Bohemian Concert was held on Saturday last at the Caxton Hall, Westminster. There was a large attendance, and conspicuous amongst the audience was a good muster of members of other Volunteer corps. The concert was an excellent one, and was much enjoyed. The songs were very well rendered by the various artists, and the "living lilliputians" caused much amusement. The evening passed merrily, as, indeed, do all such entertainments organised by "our corps."

Gas Leakage and Electric Light Mains.—Between three and four o'clock on Wednesday morning last week a short-circuit occurred on the distributor cables of the East Ham Corporation, in front of a house in Green Street, Upton Park. As the fault was dead across the outers, and well within the capacity of the generator, the current was kept on for some little time, to burn out the fault or to enable the staff to localise it. As soon as possible the section was cut out, and everything appeared to be in order. About an hour after this, some people were found in an adjoining house in a state of partial suffocation; they were sleeping in two very small attics situated at the top of the house, and were overcome with fumes or gas of some description. The people were taken to the hospital, and soon recovered.

On taking up the footpath to repair the fault, it was found that from a gas service pipe, crossing close over the top of the cable troughing, there was a large amount of gas escaping. There was no doubt that the gas had been leaking for some considerable time, and had in some way destroyed the bitumen in the troughing and the vulcanised bitumen insulation of the cables, causing the conductors to short-circuit.

Apparently the fumes from the burning fault mixed with the gas from the main, and found a way into the cellar of the house through a hollow which had been left by a disused gas service. The gas or fumes ascended to the top of the house, with the result mentioned.

University College Students' Dinner.—Mr. P. T. J. Estler, of 25, Laurence Pountney Lane, Cannon Street, E.C., the hon. sec. of the Past Engineering Students, University College, London, informs us that the annual dinner of Past Students will be held jointly with that of the Present Students at the Hotel Cecil on Friday, March 16th, at 7.30 p.m. Sir Alexander B. W. Kennedy, F.R.S., has consented to preside. We understand that these annual dinners have always been a great success, and have been the means of bringing together many old friends who have lost sight of each other. It is hoped that any old students, who have not had notice of the dinner owing to their addresses not being available, will communicate with the hon. sec. at once.

National Physical Laboratory.—The *Daily Telegraph* says that an important addition to the buildings at the National Physical Laboratory in Bushey Park has been provided by the erection of a new structure for electro-technical work, including photometry, at a cost of about £8,000, which will include equipment. It is expected that the new wing will be ready for opening in June.

A High-Tension Direct-Current Railway in Vienna.—A paper by Franz Krizik, read before the Austrian Society of Engineers and Architects at a recent meeting, gives some information concerning a new high-tension, direct-current traction installation now being tested on the Vienna railway system. This road is to be worked with electric locomotives fed with current by a three-wire overhead system, the voltage between the outside wires being 3,000 volts. The locomotives have two axles, each being driven by two 200-H.P. motors, whose pinions engage with a common gear wheel keyed to the axle. In order to obtain satisfactory commutation, the flux-density in the armature has been kept high, a large number of commutator segments has been adopted, and one turn per segment is employed. The air gap is 5 mm. ($\frac{3}{16}$ in.). At starting, all the four motors of the locomotive are connected in series across one side of the three-wire supply; as soon as the motors are fully accelerated they are connected in series across the outers of the three-wire system. If a still higher speed is desired, it is obtained by weakening the motor fields. A 160-ton train is accelerated by a locomotive at the rate of 0·42 metre per second per second (1·38 ft. per second per second) and the energy consumed to accelerate the train up to 24·8, 28, 31 and 34·2 miles per hour is 4·271, 5·461, 7·13 and 9·37 KW.-hours respectively. The average distance between stations is about 0·59 mile, and the average energy consumption per ton-mile is computed to be 75·6 watt-hours.—*Railway and Engineering Review.*

(Continued on page 393.)

THE WORKS OF MESSRS. VERITYS, LTD., AT ASTON.

(*Concluded from page 349.*)

The fittings department, figs. 12 and 13, is the oldest portion of Messrs. Veritys' business, and is housed in the original Plume Works. In this section we had ample evidence of the collaboration of the artist and engineer.

The work embraces anything from a miniature table lamp of simple outline to an electrolier, profusely ornamented and up to 30 ft. in length, together with radiators of many patterns and forged ironwork for varied purposes.

It the production of the more artistic fittings the department is aided by the possession of a valuable old collection of Italian and French models, which are faithfully copied. The designs are made either full size or drawn to scale for submitting to clients, and after being approved, the necessary working drawings are made from them.

To describe the fittings section at length would only mystify the reader, who will learn more from reference to the many interesting processes employed therein.

The majority of fittings consist in part of brass, copper or iron tubing and bar, small castings, stampings, &c., spun or hammered sheet metal work: a variety of small metal-working machinery is installed for machining the tubing, castings, &c., where necessary.

Fig. 11.—View of the Commercial Office.

Fig. 12.—Assembling Electroliers in a Fittings Shop.

The shaping of the copper leaves, flowers, scrollwork, radiator cases, &c., by means of hand-hammering is one of the most skilled operations employed in the production of better class work.

In many cases the operative hammers out the model directly from the drawing on sheet-copper, which has previously been sawn by hand to shape.

In the spinning shop, the work of moulding on a rotating lathe mandril, circular sheet metal work is carried out: this branch of the work comprises arc lamp cases, ornamental canopies for fittings, lamp reflectors, &c.

The finishing of the fittings is one of the most important branches of the work carried out, in which the plating department plays a great part. Here, by means of electrolytic deposition, the coppering, silvering, bronzing or gilding of the fitting is effected, the last-named process, of course, only affecting the most expensive class of work: subsequently the processes of polishing, scratch polishing, buffing, burnishing, chasing, &c., and then lacquering, serve to impart the many

Fig. 13.—A View in the Fittings Department.

artistic finishes which are observable on the better class fitting of the present day.

In concluding our visit to this section of the works, we passed through the smiths' shop, where many excellent examples of iron pendants, arc lamp brackets, church fittings, &c., were on view, this work largely consisting of hammered iron: and the crucible foundry, where the greater part of the brass and the emergency iron castings used by the firm are made.

Fig. 14.—A View in the Fittings Stores.

Messrs. Veritys have a special claim to notice in regard to their fittings, they having, so far as we are aware, manufactured the first electrical fitting in this country—an "electrolier," that title having been first used by the firm for Mr. Edison's great exhibit at the first Crystal Palace Exhibition in 1882 (Elec. Rev., Vol. X., p. 41).

Fig. 15.—Magnet Ring of Messrs. Veritys' Interpole Motor.

Some of the largest fittings ever put together were constructed by this firm for the Blackpool Tower; the Hotel Cecil contains many examples of their work, while even the late Herr Krupp, of German engineering fame, selected Veritys' designs for fittings for his private residence, in preference to others of both English and Continental origin.

One important and essential section of the works has remained unmentioned, *i.e.*, the stores. Stores abound almost on every floor for each branch of the business; they receive material in the rough, which passes into the works and returns either in the form of the finished product or of interchangeable parts which can be assembled in any desired form.

From the stores, the various electrical apparatus required to complete an order is drawn and having been duly labelled as to satisfactory testing and finish, passes to the packing department, whence it is dispatched to its destination.

A spacious general office (fig. 11) with its staff of clerks deals with the commercial business of the works, which employ over 700 hands.

The operations are largely carried out on the "piece work" system, and an eight hours' day with one break at midday is in vogue.

In concluding our description of the works, we may add that the plant is practically all motor driven, each shop having its one or two motors supplied from the works power plant.

Reference has been made in the course of the foregoing description to certain new apparatus which Messrs. Veritys are placing on the market,

Fig. 16.—Typical 20-light Electrolier in Natural Bronze.

and which deserves more than the passing notice which we have so far given.

Foremost, may be mentioned the auxiliary or interpole

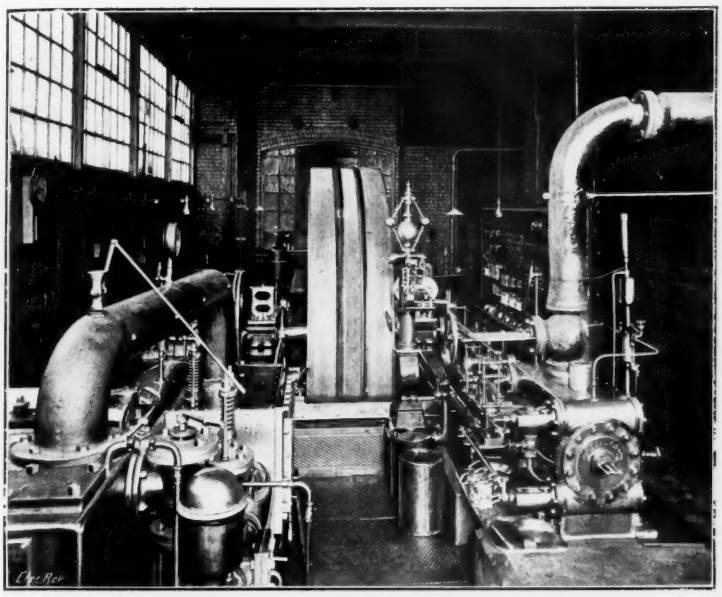


Fig. 17.—View in the Works Power House.

vpe of motor, which ill embrace all ex- ept the smallest izes, whether de- igned for shunt egulation or other- vise.

If required for shunt regulation, these motors can be employed to give a speed increase in any ratio up to about 6 : 1, the limit being dependent, of course, upon the normal speed of the motor. Even when required for ordinary duty Messrs. Veritys in nearly all cases intend to supply interpole motors. As they point out, the interpoles are no detriment to the motor for ordinary duty, in fact, quite the reverse, as they reduce sparking to an absolute minimum, while the extra cost of the interpoles is more than counterbalanced by the increased output they can get out of the materials employed.

The principle of the interpole motor is now generally understood; the magnetic field necessary for the commutation is obtained by means of small additional poles placed in the neutral line of the main field, with the result that the commutation is independent of the strength of the main field. An increase of speed in the ratio of 1 : 4 or 1 : 5 is easily obtainable by shunt regulation, and perfect commutation is obtained throughout a range extending from no load to heavy overload, without moving the brushes.

Owing to the fixed brush position the motor is specially suitable for crane work and where reversible motors are required.

Messrs. Veritys look forward to a very large demand for their interpole machines, the polar arrangement of which we illustrate in fig. 15, and all preparations are being made for dealing with an increased output in this direction.

Until recently the firm have been known as makers of small machines only, but our visit revealed the fact that motors of larger size—in fact, ranging up to 40 H.P.—form no inconsiderable proportion of their output at the present time.

Fig. 22 represents a recently designed electric crab for dealing with loads up to 2 tons in weight. The one shown is capable of lifting ½ ton 30 ft. per min., or 1 ton 15 ft. per min., and lighter loads at proportionately higher speeds.

The following features are also embodied: Hand lowering by the brake, which is magnetic and extremely sensitive, swivelling trolleys to enable loads to be handled without straining the carriage, should the weight to be lifted not be immediately below; an automatic clutch which operates the controller, thus preventing any "over" or "under" winding, and ball bearings to all parts.

Fig. 18.—The Motor Stores.

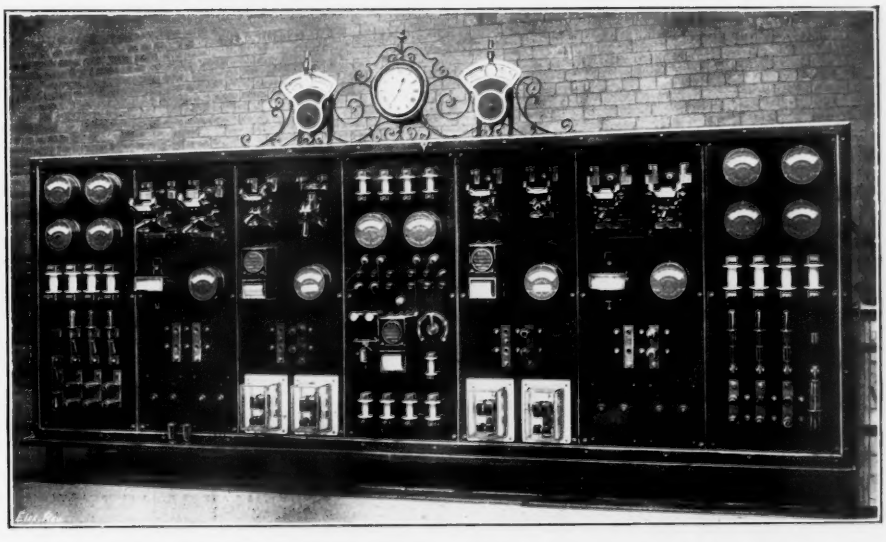


Fig. 19.—An Example of Main Switchboard Work Carried out by Messrs. Veritys.

The simplicity and handiness of this little crane, which can also be used for travelling along a jib, make it particularly suitable for foundry use, or for serving a large machine tool.

In the switch department we were much impressed with the "Cyclax" slow motion gear, which is applicable to practically

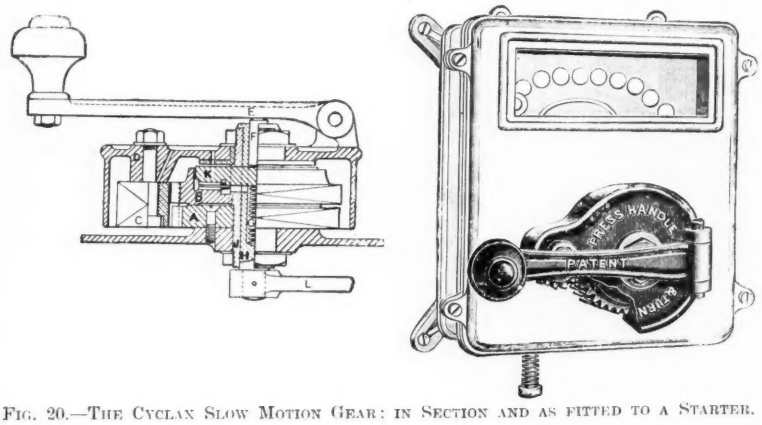


Fig. 20.—The Cyclax Slow Motion Gear: in Section and as fitted to a Starter.

any uni-directional radial arm starter, as shown in fig. 20 which illustrates the "Cyclax" gear applied to an ordinary starting switch.

The gear is fixed to the cast-iron cover plate of the starter, and as the only point at which it comes into contact with the working parts of the latter is at the radial arm (at which point insulation can easily be introduced), there is no need whatever to employ insulation in the gear, so that first consideration can be given to sound mechanical construction.

Referring to fig. 20, the gear comprises a fixed wheel A, a loose wheel B, fitted with a clutch, and an epicylic pinion C attached to the rotating cover D. Under the handle E is fitted a plunger F, which is forced outwards by the spring G, carried within the centre spindle H. The whole of this mechanism is supported on the fixed tube J, and over the wheel B is a loose clutch K, free to rotate through the angle necessary to turn the starter from the "off" to "on" position.

In operation the handle E is grasped and depressed, forcing the plunger F downward, and causing the clutch K to engage the clutch wheel B. On turning the handle the cover D is rotated, and owing to the differential gear wheels (A and B) the wheel B is rotated in the same direction as the cover, but at a greatly reduced speed, the motion being communicated through the clutch to the centre spindle, and thence to the arm of the motor starter. On releasing the arm E, the plunger F regains its normal position, and the crank L returns to the original position, leaving the starter free to release under the influence of the usual no-volt and overload devices.

Particular attention is drawn to the fact that the tube J, on which the whole of the mechanism is supported, is rigid, and extends from the inside of the starter cover to the outside of the gear cover. In fact, the good features of the ordinary starter are retained with the additional safeguard of a slow starting motion. As previously mentioned, the switch department's work embraces almost anything up to a main switchboard, and fig. represents a typical example of the latter, which speaks for itself.

Our remaining illustrations cover leading lines now well-known in the electrical trade, and of which the firm have every reason to be proud.

Fig. 21 shows the mechanism of the Aston-Worsley enclosed single carbon arc lamp, the casing and globe being removed.

The centre tube construction is not adopted in this lamp, the crown and base being rigidly held together by four parallel tubes, leaving the centre of the lamp free for the positive carbon and its carrier. The four tubes form a guide for the carbon carrier, and a noticeable feature about this method is that there is no need for the carriage to be an accurate fit between the guides, an obvious advantage should the latter become dirty. The clutch is of the simplest description, and the dash-pot is inverted.

In the twin lamp each pair of tubes suffices as a guide; both arcs are struck from the same series coil, and the absence of a shunt coil makes this lamp, if anything, simpler than the single carbon lamp. Great attention has been paid to the insulation of the negative carbon holder, which necessarily is the weakest point in a twin arc lamp, owing to the fear of carbon dust "building up" between the conducting rods. An upright mica shield effectually prevents short circuit in the negative carbon holder of the "Aston-Worsley" twin arc lamp.

Fig. 16 represents a typical 20-light electrolier in natural bronze, one of a number constructed from Messrs. Veritys'

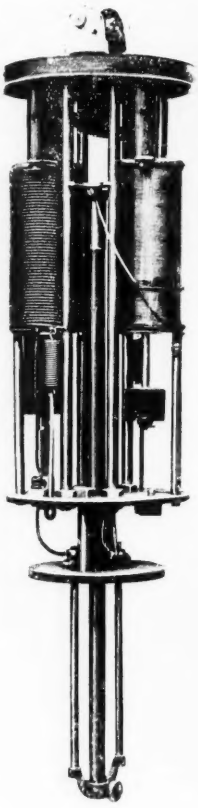


Fig. 21—A Standard Arc Lamp Mechanism.

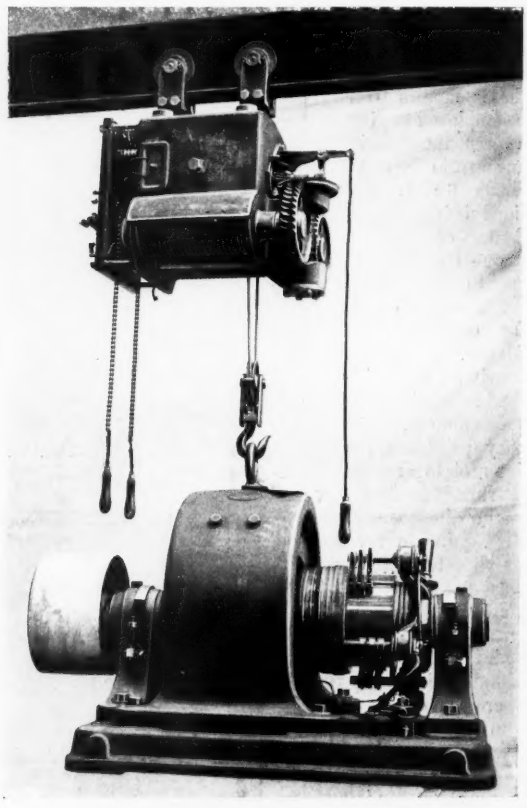


Fig. 22. An Electrical Crab for "Runway" Purposes.

original designs, for the spacious new offices of the Hearts of Oak Benefit Society in London. The design is admirable in its proportion, and reflects credit alike on the designer and craftsman, who have secured so excellent a result. The firm have the entire contract for electric light fittings, desk rails, grilles, &c., in hand.

The organisation throughout these works, with their large and varied output, is apparently most complete. The keynote is decentralisation. Each of the four main departments is entirely self-contained, and under a responsible head; indeed, each might be an independent factory. Mr. J. Fraser Lister, who is also a director, is responsible for the motor department; Mr. A. E. Gott, who is well known in controller design, has charge of the controller and switch department; Mr. F. S. Worsley, whose name is a household word in arc lamp circles, controls the arc lamp factory; while Mr. M. S. Smith is manager and chief designer of the fittings department. The other works director is Mr. P. G. Ebbutt.

In conclusion, we beg to thank Messrs. Veritys for their courtesy on the occasion of our visit, and for the excellent photographs with which our article is illustrated.

NOTES.

(*Concluded from page* 388.)

Illuminating Engineering.—Mr. L. B. Marks, president of the newly-organised Illuminating Engineering Society, delivered his inaugural address on February 13th in New York city. He stated that the approximate cost of illumination to the consumer per annum, in the United States was as follows:—

Electric light ...	...	Between $100,000,000	and	$120,000,000
Coal and water gas	...	„ 35,000,000	„	40,000,000
Natural gas ...	...	1,700,000		
Acetylene ...	...	„ 2,500,000	„	3,000,000
Oil	...	60,000,000		

At a conservative estimate the consumer was spending a total of over $300,000,000 a year for lighting in the United States. Of this amount, he said, fully $20,000,000 are wasted, so far as the amount of useful illumination delivered for the money was concerned. No one who had made a study of the subject could fail to see the glaring examples of this waste on every hand. It was not at all uncommon to find with electric lighting that 25 per cent. of the light furnished was lost, so far as any useful purpose was concerned, by reason of improper disposition of the light sources or unsuitable equipment of lamps, globes, shades or reflectors.

Football.—On February 21st the annual football match between the Reading Corporation Tramways and the London United Tramways Company took place on the Elm Park football ground, Reading. The Mayor of Reading kicked off. The game resulted in a victory for the Reading Corporation Tramways by 3 goals to 1. Both teams were entertained to a substantial repast by Mr. Councillor A. H. Bull, the Chairman of the Tramways Committee, after the match, and, in the absence of Mr. Bull, Mr. Walter Binns, the general manager and engineer of the tramways, presided. The remainder of the evening was given up to social enjoyment. This is the third occasion on which the match has been played in Reading, and on each occasion the Reading men have been victorious.

Municipal Accounts.—On Monday last there was held at the Hôtel Metropôle, a conference of chambers of commerce, industrial associations, municipal corporations and local authorities to discuss the recommendations of the Joint Parliamentary Committee on Municipal Trading, 1903, and the best means of securing their adoption as regards the independent professional audit of municipal accounts, and the standardisation of such accounts. The following resolution was passed after discussion:—"That this conference, representing chambers of commerce, industrial associations, municipal corporations and local authorities, expresses its regret that effect has not been given to the recommendations of the Joint Select Committee on Municipal Trading as regards appointing independent professional auditors of municipal accounts." Among other resolutions also passed after discussion of amendments, was one to the effect that "this conference is convinced of the desirability of securing as far as possible, the standardisation of municipal accounts on business lines, and recommends that, so far as practicable, such accounts be kept on the basis of income and expenditure, and also that trading and profit and loss accounts be prepared yearly of the various commercial undertakings of such authorities."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—On Saturday last, at the Stamford Electricity Works, Mr. Reginald Hall, who has acted as assistant at Stamford and Grantham for the last three years, was presented by the employés of both towns with a silver cigarette case upon the occasion of his leaving to take up work with the Newcastle Electric Supply Co. The manager, Mr. J. E. Edmundson, made the presentation. Mr. Alex. More, of Brechin, has been appointed to fill the vacancy.

Mr. J. W. Hogg, of the Paisley Corporation Electricity Department, has secured an appointment as mains engineer with the Calcutta Electric Supply Corporation, Ltd., Calcutta.

The third annual dinner of the staff of the Fulham Borough Electricity and Destructor Works was held in the King's Hall, Fulham, on Friday, 2nd inst., Mr. Arthur J. Fuller, the borough consulting and electrical engineer, being in the chair. Between 80 and 90 of the staff sat down, and after dinner the company enjoyed a long musical programme, which was interspersed with various toasts.

The Dover T.C. has appointed Mr. E. W. Smith, senior shift engineer, to succeed Mr. C. H. Lydall as works superintendent at the electricity works at a salary of £160 per annum, increasing by £20 a year to £200.

Mr. A. C. J. Reynolds, senior shift engineer at the Gillingham (Kent) Electricity Works, who is leaving for the Tyne, has been presented by the staff with a silver cigarette case.

By the casting vote of the Mayor, Wrexham T.C. has referred back to committee a recommendation that the salary of Mr. Sillery, electrical engineer, be increased from £200 to £225 per annum, on the understanding that the increase is to cover services rendered in connection with the extension of the undertaking.

The annual dinner of the Croydon Corporation Electricity Works was held last Friday. Mr. Alex. C. Cramb, the borough electrical engineer, was in the chair. Over 100 sat down.

Mr. C. F. Butler, managing engineer to the County of Northampton Electric Power and Traction Co. at Wellingborough, has left that company, and is taking up a similar position with the Lewes and District Electric Supply Co., at Lewes. He is succeeded at Wellingborough by Mr. G. W. Bunting, of Sheerness. Mr. Butler was last week presented with a marble clock and ornaments by the Wellingborough staff and friends.

Tramway Officials.—The Leyton U.D.C. has appointed the following gentlemen as clerks of works to superintend the construction of the tramways permanent way:—Mr. John Goldsworthy, Leyton; Mr. F. McCarthy, Dartford; and Mr. J. Smith, Leyton. There were 145 applicants.

The marriage of Mr. W. T. Dalton (superintendent engineer of Newcastle-on-Tyne Corporation tramways), only son of the late Brockwell Dalton (late editor and manager of the London *Observer*) to Miss Elsie Mansfield, fifth daughter of the late Albert Mansfield, professor of music and formerly director of the Royal Artillery and Westminster Volunteers' bands, was solemnised at St. Paul's Church, Whitley Bay, on 1st inst. Among the presents received was an oak writing desk and a case of cutlery given by the Corporation tramway staff and presented by Mr. E. Hatton, the general manager.

General.—Mr. H. S. Distin, Swansea, district manager for the National Telephone Co. at Swansea, has been appointed to Exeter, and Mr. W. E. Gauntlett, district manager at Gloucester, is to succeed him.

Mr. R. Weatherburn, locomotive superintendent for London and district for the Midland Railway Co., is retiring after 30 years' service. He is to be succeeded by Mr. E. E. A. Talbot, locomotive superintendent for Normanton and district, who will also take over the electrical work, which has been hitherto attached to another section of the locomotive department. It is reported that Messrs. C. H. Jones and W. H. Adams, divisional locomotive superintendents, who have been with the same company for many years, are also retiring.

Mr. A. Kaye Butterworth, solicitor to the North-Eastern Railway Co., has been appointed general manager, in succession to Sir George Gibb, Mr. Philip Burtt, the deputy general manager, has been appointed chief traffic manager, and he will continue to act as deputy general manager.

Mr. Stephen S. Sellick, who for eight years has been engaged in electrical work in China, has just returned to this country, after a tour in Japan, Australia and India. With reference to the electric lighting installation at Tientsin, described in our issue of February 23rd, the original accepted scheme and estimate was drawn up by Mr. Sellick, then chief electrical engineer of Messrs. Arnhold, Karberg & Co., assisted by Mr. G. van Corbac, who subsequently carried out the erection of the plant.

NEW COMPANIES REGISTERED.

Kryptol Syndicate, Ltd. (87,682).—This company was registered on February 21st, with a capital of £15,000 in £1 shares, to acquire the British patents, trade marks and rights in respect of "Kryptol," and to carry on the business of electrical, mechanical and general engineers, founders, metal workers, &c. The first subscribers are:—A. Voelker, 6-8, Scrutton Street, Finsbury, E.C., electro-chemist, 100 shares; H. Hälsen, 37, Mincing Lane, E.C., merchant, 100 shares; G. H. Daniell, 20, Great Winchester Street, E.C., solicitor, 1 share; C. Tucker, 3, Bedford Road, East Finsbury, N., merchant, 1 share; C. H. Barham, 5-6, Bishopsgate Street Without, E.C., solicitor, 1 share; A. Gallenkamp, 106, Mount Pleasant Lane, Upper Clapton, N.E., merchant, 1 share; and A. E. Glover, 12, Gunton Road, Upper Clapton, N.E., solicitor, 1 share. Minimum cash subscription, £1,000. The number of directors is not to be more than seven; the first are A. Voelker and H. Hälsen; qualification, £100; remuneration, £100 each per annum, and quarter of the distributed profits in excess of 10 per cent. Registered office, 6-8, Scrutton Street, Finsbury, E.C.

Limia Co., Ltd. (87,734).—This company was registered on February 24th, with a capital of £10,000 in £1 shares, to acquire and take over the concession granted by the King of Spain to Dona Carlota Partington y Cárcer Marquesa de Longueville for the reclamation of certain lands in the valley of the River Limia, Province of Orense, N.W. Spain, and for the installation of electrical power for traction and industrial purposes in the said province, to adopt an agreement with the said vendor, and to carry on the business of drainers, clearers, irrigators, reclaimers, improvers and cultivators of land, constructors of roads, railways, tramways and other works, electricians, engineers, manufacturers of and dealers in electrical apparatus, installers and suppliers of electricity, &c. The first subscribers (each with one share) are:—T. Greenhill, 7, Tanza Road, Hampstead, N.W., director; L. E. Chagniat, 67, Filmer Road, Fulham, S.W., merchant; A. L. Lambert, 7, Oval Road, Regent's Park, N.W., director; T. F. Turner, 47, Canonbury Square, N., secretary; A. Ireland, 58, Blenheim Road, Walthamstow, clerk; T. M. de Bingham, 78, King Street, Manchester, engineer; and H. H. Syms, 70, Queen Victoria Street, E.C., solicitor. Minimum cash subscription, 200 shares. The number of directors is not to be less than two nor more than seven; the first are T. Greenhill, L. E. Chagniat, A. L. Lambert, T. F. Turner, A. Ireland, T. M. de Bingham and H. H. Syms; qualification (except first directors), £50; remuneration, £150 each per annum (chairman £50), and 5 per cent. of the net profits available after 10 per cent. dividend has been paid on the ordinary shares, divisible. Registered office, 11, Queen Victoria Street, E.C.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—This company was registered on February 23rd, with a capital of £30,000 in £1 shares (12,000 preference), to adopt an agreement with Z. Hirtzel, of Nairobi, East Africa Protectorate, and to carry on in the said Protectorate and elsewhere the business of producers, suppliers and sellers of electricity for power, light, heat, traction or other purposes, &c. The first subscribers are:—General Sir Stanley de Burgh Edwardes, Sponden, Sandhurst, Kent, 100 shares; E. M. Preston, Shirley Hurst, Shirley, near Croydon, engineer, 2,000 shares; Major L. H. Vidal, 4, Bond Court, Walbrook, E.C., 100 shares; A. G. Preston, Kelsey Park, Beckenham, engineer, 1,000 shares; W. H. Hooker, 2, Grove Park Road, Chiswick, retired, 10 shares; T. A. Glenny, 80, Clifton Hill, St. John's Wood, director, 10 shares; and J. H. Parker, 37, Royal Exchange, Eastbourne, secretary, 10 shares. No initial public issue. The number of directors is not to be less than two nor more than seven; the first are General Sir Stanley de Burgh Edwardes, K.C.B.; E. M. Preston and Major L. H. Vidal; qualification, 100 shares; remuneration (except managing director), three guineas each per board meeting attended (maximum for whole board, except managing director, £150 per annum). The preference shares carry a cumulative preferential dividend of 6 per cent., and take half of any surplus profits remaining after 6 per cent. has been paid on the ordinary shares. Registered office, 28, Martin's Lane, Cannon Street, E.C.

Caledonian Electric Wire Co., Ltd. (6,109).—This company was registered in Edinburgh on February 19th, with a capital of £2,000 in £1 shares, to cover and insulate wires, cables and other metal conductors used for electrical or any other purpose, and to carry on the business of electricians, electrical and mechanical engineers, &c. The first subscribers (each with one share) are:—William Spriggs, 113, Bath Street, Glasgow, merchant; W. J. Walker, 6, Ingleby Drive, Dennistoun, electrical engineer; T. Walker, 6, Ingleby Drive, Dennistoun, electrical engineer; W. Williamson, 197, West Princes Street, Dennistoun, accountant; R. Hardie, 65, Renfield Street, Dennistoun, C.A.; W. Jeffray, 73, McAlpine Street, Dennistoun, sawmiller; and A. Peacock, Ardmillan, Larch Road, Dumbreck, baker. The number of directors is to be three; the first are Henry W. Warde, Percy J. Sims and W. J. Walker; qualification, 50 shares; remuneration as fixed by the company. Registered office, 65, Renfield Street, Glasgow.

Accessible Battery and Engineering Co., Ltd. (87,644).—This company was registered on February 19th, with a capital of £1,500 in £1 shares, to acquire the business carried on at 39, Victoria Street, Westminster, as the "Accessible Battery Co.," to adopt an agreement with A. J. Fippard and C. L. Cartwright, and to carry on the business of electrical, mechanical, practical and chemical engineers, electricians, suppliers of electricity, manufacturers of and dealers in electric batteries, cells, and other apparatus, &c. The first subscribers (each with one share) are:—C. B. Marshall, 11, Carteret Street, Westminster, solicitor; T. Hucklebridge, 7, Grange Road, Gunnersbury, W., surveyor; A. J. Fippard, 39, Victoria Street, Westminster, electrical engineer; C. L. Cartwright, 39, Victoria Street, Westminster, civil engineer; D. W. Ratcliff, 9, Cardigan Mansions, Richmond, electrical engineer; E. Ward, 17, Victoria Street, Westminster, electrical engineer; and H. Childs, 11, Carteret Street, Westminster, clerk. No initial public issue. The number of directors is not to be less than two nor more than five; the first managing directors are A. J. Fippard and C. L. Cartwright (both permanent); qualification, £100; remuneration of managing directors, £240 each per annum. Registered office, 39, Victoria Street, Westminster.

Commercial India-Rubber Manufacturing and Supply Co., Ltd. (87,760).—This company was registered on February 28th, with a capital of £5,000 in £1 shares, to acquire the business carried on by F. W. Ingram at 585, Commercial Road, London, as the "Commercial India-Rubber Manufacturing and Supply Co.," and to manufacture and deal in india-rubber and rubber goods, including surgical, medical and electrical appliances and requisites, &c. The first subscribers (each with one share) are:—F. W. Ingram, Craigmillar, Grove Road, South Woodford, Essex, manufacturer; G. F. Hoane, 16, Disraeli Road, Forest Gate, E., clerk; A. D. Ingram, Craigmillar, Grove Road, South Woodford, Essex, manager; S. Taylor, 102, Warren Road, Leytonstone, N.E., clerk; F. W. Miles, 90, Sherrard Road, Forest Gate, E., clerk; R. W. Harding, 41, Elthorne Road, Upper Holloway, N., clerk; and S. Baster, Hazeldean, Mill Lane, Chadwell Heath, Essex, manager. No initial public issue. The number of directors is not to be less than two nor more than five; the first are F. W. Ingram and S. Baster; qualification, £100.

Bodie Electric Syndicate, Ltd. (87,756).—This company was registered on February 28th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical and surgical belts, batteries and electrical appliances of any kind, manufacturers of and dealers in patent medicines, &c. The first subscribers (each with one share) are:—M. Pohle, 37, Stroud Green Road, N., merchant; R. A. S. Burnham, 163, Blackfriars Road, S.E., manager; Major O. Kent, 5, Promenade Place, Vane Street, Hull, theatrical manager; W. M. Norman, 122, City Road, Bristol, manager to Dr. W. Bodie; H. J. Sim, 26, Coldharbour Lane, Camberwell, S.E., chemist; W. Henry, 163, Blackfriars Road, S.E., assistant manager; and F. L. Thorpe, Elmsleigh, Natal Road, Thornton Heath, manufacturer. No initial public issue. The number of directors is not to be more than three; the first are E. A. Mackenzie, C. H. Mackenzie and F. L. Thorpe; qualification, (except first directors, who require none), 50 shares; remuneration as fixed by the company. Registered office, 11, Poultry, E.C.

The St. Helens Cable and Rubber Co., Ltd. (87,774).—This company was registered on February 28th, with a capital of £10,000 in £1 shares, to acquire the business of the St. Helens Cable Co., Ltd., to adopt an agreement with Callender's Cable and Construction Co., Ltd., the British Insulated and Helsby Cables, Ltd., and Siemens Bros. & Co., Ltd., and to carry on the business of cable makers, manufacturers of india-rubber goods, wire rope makers, suppliers of electricity, electricians, electrical and mechanical engineers, &c. The first subscribers (each with one share) are:—C. W. Clarke, 29A, Yukon Road, Balham Hill, S.W., clerk; B. W. H. Kigbere, Elm Road, New Malden, clerk; H. E. Albert, 22, Nightingale Lane, Hornsey, clerk; H. G. Frederick, 15, Forthbridge Road, Clapham Common, clerk; E. Capper, 23, Heythorpe Street, Southfields, S.W., clerk; H. E. Harrison, The Lilacs, Leatherhead, secretary; and W. Allnutt, Percy Lodge, Miteham Junction, accountant. No initial public issue. The number of directors is to be three, one of whom is to be appointed by the holders of the shares numbered 10 to 4,206 (known as the "Callender Co." shares), one by the holders of shares numbered 4,207 to 8,703 (known as the "B.I. Co." shares), and the third by the holders of the remaining shares numbered 8,704 to 10,000 (known as the "Siemens Co." shares). The first directors are T. O. Callender ("Callender" director), J. Taylor ("B.I. Co." director), and G. Von Chauvin ("Siemens" director); remuneration as fixed by the company. Registered office, Warrington, Lancs.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Law Press, Ltd. (London) (72,435).—Issue on February 15th of £100 7 per cent. debentures, part of series created November 9th, 1905, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £700.

Rangoon Electric Tramway and Supply Co., Ltd. (86,932).—A trust deed dated February 1st, 1906, to secure £150,000 debenture stock, has been registered. Property charged: Certain freehold and leasehold property in Rangoon and the company's undertaking and other assets, including uncalled capital. Trustees: Sir John Gray Hill, Kt., 10, Water Street, Liverpool; and R. Henderson, 17, Water Street, Liverpool.

Eastern Telegraph Co., Ltd. (6,338 C).—This company's annual return was filed on February 19th, when £3,999,890 ordinary and £2,000,000 preference stock had been taken up out of a nominal capital of £6,000,000 in £4,000,000 ordinary and £2,000,000 preference stock. £5,999,890 has been received. Mortgages and charges: £1,907,704.

Direct United States Cable Co., Ltd. (11,597).—This company's annual return was filed on February 21st, when 63,710 shares had been taken up out of a nominal capital of £1,300,000 in 65,000 shares of £20 each. £1,214,200 is considered as paid. Mortgages and charges: Nil.

Electric Canal Haulage Co., Ltd. (60,462).—This company's annual return was filed on February 23rd, when seven shares had been taken up out of a nominal capital of £3,000 in £1 shares, and £7 had been received. Mortgages and charges: Nil.

Central Electric Supply Co., Ltd. (53,080).—This company's annual return was filed on February 5th, when the entire capital of £100,000 in £5 shares had been taken up and paid for in full. Mortgages and charges: £336,876 4 per cent. guaranteed debenture stock.

ELECTRIC TRAMWAY ACCOUNTS.

Hull and Birkenhead Corporation Tramways.

Our analysis of the present issue deals with the returns of two similar undertakings—similar in point of route mileage, in that they both possess independent generating plants and that either can show creditable working costs. When we come to the traffic returns, however, the relative tramway values of the two towns are at once apparent, the Hull returns reflecting the value of its larger and more prosperous population.

Compared with 1904, the gross profit of the latter undertaking has increased from £38,068 to £46,953, and its surplus, after meeting interest and sinking fund charges, enabled substantial contributions to be made to reserve and the relief of the rates; balances of £8,000 (1905) and £11,500 from previous years, or a total of £19,500 being carried forward.

The Hull Tramways Reserve Fund now amounts to £51,782.

The Birkenhead decreased traffic receipts are attributable to the severe trade depression in that town, but careful management resulted in reduced operating expenses and a higher gross profit than in 1904 resulted, viz., £22,093, compared with £21,325.

After meeting financial charges, a surplus of £1,893 remained, which, as in previous years, was placed to renewals account, together with £250, interest accumulated. The renewals fund now amounts to £10,564. In its two generating stations the Birkenhead undertaking possess a rather doubtful blessing, the South-End generating plant being almost superfluous on such a system.

Mr. W. J. M'Combe is the manager of the Hull tramways undertaking, and Mr. W. Wyld similarly controls the Birkenhead system.

General Statement for the Year Ending March 31st, 1905.

	Hull.	Birkenhead.
Length of route	13½ miles.	13½ miles.
Total length of track	25 „	23½ „
Cars in use	73	—
Car-miles per annum	2,910,698	1,309,903
Passengers carried per annum	27,102,921	11,145,531
Capital expended to date	£390,740	£350,811
Traffic receipts	£112,651	£53,769
Total receipts	£113,692	£55,026
Working expenses	£66,739	£32,933
Gross profit	£46,953	£22,093
Income per car-mile	9·38d.	10·08d.
Working expenses per car-mile	5·5d.	6·03d.
Interest and sinking fund per car-mile	1·63d.	3·70d.
Total expenses per car-mile	7·13d.	9·73d.
Profit or loss per car-mile	+2·25d.	+·35d.
Cost of energy per car-mile	·61d.	·67d.
Average fare per passenger	1·00d.	1·16d.
Revenue per mile of route	£8,422	£4,080
Expenditure per mile of route	£4,943	£2,440
Total units used	3,696,700	2,276,901
Units used per car-mile	1·27	1·73
Percentage of working ex'es to receipts	58·7%	59·84%

Profit Statement—		
Interest on loans	£10,581	£10,616
Sinking fund	9,148	9,583
To reserve	7,724	—
To relief of rates	11,500	—
Year's surplus	8,000	1,894
Gross profit	£46,953	£22,093

CITY NOTES.

Newcastle-upon-Tyne Electric Supply Co.

The directors' report for 1905 says that the total units sold amounted to 30,378,852, which, compared with the previous year's figures of 17,132,153 units, shows an increase of 13,246,699. The units sold for power purposes in the company's area, amounted to 11,479,493, and the bulk supply to the County of Durham Electrical Power Distribution Co., Ltd., and the County of Durham Electric Power Supply Co., under the new agreement, to 6,130,709. The profits of the year, including the balance of £872 8s. 11d. brought forward from 1904, amount to £74,653, out of which there have been paid interest on debentures and loans £12,355, and interim dividends, paid in July last, of 2½ per cent. on the preference and ordinary shares £18,515, leaving a balance of £43,783. The directors recommend a further dividend of 2½ per cent. on the preference shares, and 5½ per cent. on the ordinary shares, for the half-year, making total dividends for the year of 5 per cent. and 11 per cent. respectively; there is transferred to depreciation account £12,500, and £1,354 is carried forward. The amount received from the County of Durham Electrical Power Distribution Co., Ltd., under the new working agreement, to meet the reduction in the company's revenue arising on cancellation of the old contract and other contingent expenses, was £50,000; against this has been charged the reduction in revenue referred to for the year 1905, the premium paid on purchase of Durham Co.'s shares, and the costs and expenses incurred in carrying into effect the new working agreement £20,235, leaving to be carried forward to meet similar contingencies, depreciation, &c., £29,765. The premiums received during the year on the final call on shares issued in 1904 amounted to £3,517. These have been transferred direct to the credit of reserve account, thus increasing that account to £24,684, and of this amount there is transferred to depreciation account £12,500, leaving a balance on reserve account of £12,184. The amount so transferred to depreciation account, added to that of £12,500 set aside out of profits, will increase the depreciation account to £156,000.

The expenditure on capital account during the year, necessitated by the further extension of the Carville power station and of the system generally, has been £45,037. The negotiations in connection with the County of Durham Electrical Power Distribution Co. and the County of Durham Electric Power Supply Co. have been completed, and the payments made as they became due. The company now hold 10 preference and 9,815 ordinary shares in the County of Durham Electrical Power Distribution Co. During the year certain buildings, &c., at Neptune Bank and certain plant at Gosforth and Willington sub-stations have been sold to the Tyneside Tramways and Tramroads Co. for a sum of £13,000, payment for the same being taken by an allotment to this company of 1,300 £10 shares in that company. The business of the Priestman Power Co., in which the company is interested, is developing satisfactorily, and a dividend of 5 per cent. has been paid for the year 1905. In order to meet the expenditure on current and future extensions, which have become necessary through the rapidly growing demand for electrical energy, it is proposed to take powers for the increase of preference and ordinary share capital by £250,000. It is also proposed to create second mortgage debentures to the extent of £250,000, and to issue in the autumn of this year £175,000 of such debentures. These second mortgage debentures will, on January 1st, 1912, when the present issue of first mortgage debentures becomes due, be converted into first mortgage debentures.

County of Durham Electrical Power Distribution Co.

The report for the year 1905 says that the total units sold were 6,190,709, an increase of 1,753,110. Of the units sold, 5,786,610 were for power purposes, and 404,099 for lighting. The profits for the year, including a profit of £1,057 made on sale of land, plant, &c., amount to £15,724, out of which an interim dividend was paid in October last of 2½ per cent. on the preference shares £2,890, leaving an available balance of £12,834. A further dividend of 2½ per cent. on the preference shares, making a total of 5 per cent. for the year; and a dividend at the rate of 4 per cent. per annum on the ordinary shares are recommended, absorbing £10,679; and £1,083 is transferred to depreciation account (the profit obtained on the sale of land and plant) leaving £1,072 to be carried forward. The capital expenditure during the year has been £50,224, and further shares to the value of £58,480 have been acquired in the County of Durham Electric Power Supply Co. A sum of £50,000 has also been paid to the Newcastle-upon-Tyne Electric Supply Co. in accordance with the agreement, which has, as anticipated, proved advantageous to the company, a considerable reduction in the working costs having resulted therefrom. The extension of the system of general distribution is in active progress throughout the districts where the company holds provisional orders, and it is anticipated that an additional supply of energy will be available early in the summer. To further develop the demand for electricity for lighting, the price of energy for that purpose was reduced to 3½d. per unit, less 5 per cent. discount, as from July 1st last. The Whickham electric lighting order has been transferred to the company, and a supply of energy for lighting and power purposes is now being given. In April last the unissued capital of £350,000, consisting of 30,000 preference shares and 40,000 ordinary shares of £5 each, was offered to the public for subscription, and was fully subscribed. The expenses of the issue have been carried to a suspense account.

Hart Accumulator Co.

The report presented at the annual meeting held at Stratford on February 28th states that the profit for the year 1905 was £6,937, and the balance brought forward from last year £6,413. After deducting the dividend on preference shares, £328, the balance standing to the credit of profit and loss account was £13,022. The directors recommended the payment of a dividend of 12½ per cent. per annum on the ordinary share capital, absorbing £5,000, and placing £1,000 to reserve fund, leaving £7,022 to be carried forward. The company's buildings, plant, tools, &c., have been augmented by £9,164, which has been charged to capital, and due depreciation on same has been made. The maintenance of the works, plant, &c., has been well kept up at a cost of £653 19s. 7d., which has been paid for out of revenue.

From a report of the meeting as furnished to us by the company, we gather that the Chairman, Mr. G. W. Kidd, said that although competition had been as great as ever, and the price of the chief of their raw materials had at times gone up about 40 per cent., they had only been able to increase their prices by 5 per cent. This, to many, might seem a paradox, but the explanation of the satisfactory balance-sheet now before them lay in the fact that through careful attention to details, and through improvements introduced in almost every branch by their energetic manager, Mr. Clark, the expenses in manufacture had been reduced to a minimum, and the sales very largely increased. The results arising from their exhibition at Olympia had been extremely gratifying. The new buildings they were now in had been put up at a cost of nearly £14,000. They invited tenders for the erection, but as they considered the offers too high, they decided to build the premises themselves. Thereby they saved a considerable sum of money. The whole of the buildings were lighted by electricity, and all the plant in these new works was to be driven by the same agency. They had entered into an agreement with the local authority to supply them with electricity in bulk at a special rate.

The report was adopted.

A vote of thanks to Mr. Clark, Mr. Poulton, and his staff was unanimously passed.

Cambridge Electric Supply Co.

Mr. D. Munsey presided at the annual meeting held on February 28th. In moving the adoption of the report (see Electrical Review, February 23rd), he said that in 1904 they issued £30,000 worth of debentures which required £1,350 yearly. They also reduced the price from 7d. to 6d. per unit, which cost about £1,100 a year. They had recouped themselves for these outlays by doing extra business. Respecting the reduced dividend, they carefully considered this matter and came to the conclusion that it would be wise to put a larger sum to the depreciation fund. They had put £750 more to this fund than in 1904, which accounted for a drop of about 1 per cent. on the dividend. They could have paid the 7 per cent. as before, but wished to be on the safe side. During the year they had had two new steam dynamos, and also one new boiler to enable them to supply the increased demand. They had now about completed the alterations to their buildings, and had so arranged them that they would accommodate a great deal more plant whenever they should require it. The addition to their assessment meant that they had to pay £400 more yearly to the Corporation in rates, making their total between £700 and £800 a year. That was a tremendous amount, and was a very serious matter. If they put all the banks in Cambridge together they did not pay so much in rates as this company. This £700 a year meant 1 per cent. on their dividends, and they would not be content until they had got it materially reduced.

Mr. A. Campbell Swinton seconded the adoption of the report, and it was carried.

Northwich Electric Supply Co.

The report submitted at the annual meeting of the company held at Northwich last week showed an increase in revenue of £144. The motor load had increased by 6,059 units. The economy in working the new plant, mentioned in the last report, had been fully realised. Not only had the interest on the new debentures been earned, but the directors were able to recommend a somewhat improved dividend on the ordinary shares, as well as to increase the amount put to depreciation. After writing off sundry small sums, including an item of £60 13s. 9d. on free wiring account, and adding £500 to the depreciation fund, as compared with £400 last year, a net profit remained of £505, to which £25 brought forward had to be added. The directors recommended the payment of a dividend of 2½ per cent., which would absorb £453 12s. 6d., and leave £77 to be carried forward.

Western Telegraph Co.—The directors have declared an interim dividend of 3s. per share, or at the rate of 6 per cent. per annum for the quarter ended December 31st, 1905.

South Wales Electrical Power Distribution Co.

The directors in their report for 1905 state that the revenue for the year for current and meter rents was £11,414, and the H.P. connected up to that date was 6,138. The customers are slow in getting their arrangements completed. There is, however, a steady increase going on. Up to the end of the year some of the largest and most important consumers had not commenced to take their supply. They are, however, at work, and anxious to get their motors connected up, and to commence taking their supply of energy from the mains, and to disuse their existing methods of driving. Among the larger consumers who are in this position are the Locket's Merthyr Colliery, Ltd., at Mardy, 399 H.P.; Messrs. D. Davis & Sons, Ltd., Ferndale, 1,463 H.P.; Messrs. D. Davis & Sons, Ltd., Bodringallt, 80 H.P.; the Great Western Colliery Co., Ltd., Pontypridd, 267 H.P.; the Penrikyber Navigation Colliery Co., Ltd., 680 H.P.; and the Tirpentwys Steam Coal Co., Ltd., 525 H.P. These have all actually ordered the complete electrical equipment necessary for electrical driving from their contractors, and in the case of Mardy and Ferndale it is actually delivered and about to be put into work. In no case, however, is the full horse-power put into operation at the start. The conversion is a gradual process, even after delivery of machinery. At Mardy the supply is now in use to a small extent, and at Ferndale also a commencement has just been made in the actual operation of some of the new electrical machinery. The generating plant which the company have in position and in actual working order, together with two engines of 1,250 H.P. each which have been on order for a long time past, and are now about to be delivered, is sufficient to deal with a total of some 16,000 H.P. connected to the mains. It is generally found that at a maximum not more than half of the horse-power connected is at work at any one time. It will not be possible to connect a total of 16,000 H.P. to the mains without some further capital expenditure, but there is every promise of getting such an amount connected without anything like a proportionate expenditure to that which has been necessary up to date, for the reason that the extensions of mains, &c., necessary to connect a considerable additional amount of horse-power will only consist of comparatively short branches from the existing main routes. There will be overhead mains on poles in all cases where wayleaves can be satisfactorily obtained. Two such overhead lines are at present being carried out by the contractors, and four more are now being surveyed and negotiated for. If the revenue which this 16,000 H.P. can bring in is at the same rate as that already received, the company will by the time it is connected be earning a gross revenue sufficient to cover all expenses chargeable against revenue, and the debenture interest. At the present time the revenue is at the rate of £2 10s. per annum per H.P. connected to the mains. While the revenue before mentioned has been calculated upon this figure, there is good reason to believe that it will be improved upon. In order to meet the prospective and ever-increasing demand for power, it has been found necessary to spend a larger amount of capital than was expected a year ago, and further extensions will from time to time be needed; while, from circumstances beyond the directors' control, and delays upon the part of customers, the anticipated revenue has not yet been realised. A Bill is being promoted in the present session of Parliament to authorise the creation and issue of further capital for the purpose of the Carmarthenshire undertaking and for the general purposes of the company. A formal resolution will be submitted to the shareholders transferring the whole of the preliminary expenses, including the costs of obtaining the Act of Parliament and of the promotion of the company and the issue of its capital, to a special suspense account, to be written off out of the profits of the undertaking by a series of annual payments spread over a series of years, in accordance with the suggestion of the B. of T. auditor. Sir W. T. Lewis, Bart., Mr. E. P. Martin, and Mr. J. Weston-Stevens have resigned their seats on the board. Mr. T. U. Weguelin has been elected to the seat vacated by Sir W. T. Lewis.

Yorkshire Electric Power Co.

The meeting of this company was held at Leeds on February 27th, Mr. A. G. Lupton presiding.

In moving the adoption of the report (see Electrical Review, February 23rd), the Chairman said that all the shares were now fully paid up. There was an increase of 595 shares during the half-year, and these had been applied and paid for by contractors in accordance with the terms of their contract. More than half of the new capital expenditure was for mains, and the other was for the equipment of sub-stations, and so on. With regard to the request of some of the shareholders for a revenue account, it was the usual custom with similar companies in the initial stage not to issue such an account. The sales of current were small, and they appeared along with the receipts for sales of energy, bank interest and so on—sundry receipts, £1,297. When the revenue was a little larger they would issue an account in the ordinary way. They had given supply for just a year, but the sales of current in the first half-year were only £149. In the third quarter they were practically doubled, and in the fourth quarter they more than doubled again the third quarter. The number of customers was increasing, and one of the most hopeful things was that several customers who took power at first in a tentative manner were increasing the number of their motors. Mr. Parshall, their consulting engineer, had made an analysis of their receipts and expenses and the agreements in force, and he reported that, on the basis of the current returns, the gross profit which might be expected from the business generally when the plant was in full operation, would yield a higher percentage on the capital than was anticipated when the company was formed, for although the receipts per unit were less than was expected, the expenses were lower in proportion; and, further, owing to a better distribution of the load, a larger aggregate of consumers could be supplied from the same plant. Their station was now, with the exception of the third set of turbines which were being erected, practically complete. They had been able to run it sufficiently to really know what they had got. The contractors had tendered for a total of 4,500 KW., but the directors found that they could safely rate the capacity at 6,000 KW., which made an important difference in the load they would be able to put upon it. All the company wanted now was customers. The company was not developing as rapidly as they might wish.

In reply to questions, the Chairman said that the maximum load they had got up to at any moment was about 700 H.P. They had been very much struck by the demand of half-a-dozen coalpits close together which could be run from one central station, and which would build up a future supply for a future bigger station, and they were considering at present the putting down of a small central station, with what one might call almost a temporary plant, but which could be run for a good many years, and could then be removed to another place, so as to supply any particular local demands. It had not taken shape yet. They believed there was a very definite increase of business to be got from that. It would enable these rather further away districts to be developed and nursed up into a big demand for the future. It was in the neighbourhood of Cudworth and Mexborough. They asked for £600,000 capital originally, and intended to put down plant for four central generating stations, but times were against them, and they did not get as much as they asked for. They had had negotiations with some of the large tramway companies. One difficulty was that the tramways in many cases were bound to buy from their local authorities, since the local authority gave its assent to the tramway coming through its district on condition that it should buy its current from the local authority if it had a generating station, and it tied their hands very much.

The report was adopted.

South London Electric Supply Corporation.

The directors' report for the year 1905 says that the revenue account shows that the total receipts amounted to £76,473, and the outgoings to £43,990, leaving the sum of £32,483 as the gross profit earned. After making adequate allowance for depreciation and preliminary expenses, and making due provision for interest accrued on borrowed capital, there remains to be carried to the general balance-sheet a sum of £22,042. Out of this the board recommend the payment of a dividend at the rate of 4 per cent. per annum on the ordinary shares, carrying forward a balance of £9,042.

In order to protect the interests of the shareholders, it has been necessary to expend a large sum in law costs. These have been principally incurred in opposing power Bills in the last Parliamentary session, the whole of the amount being charged against the year's revenue. It has again been necessary to lodge petitions against some of the Bills introduced in the current session, but it is hoped that the charges this year will be considerably less. At the end of 1905 there were connected to the company's mains the equivalent of 120,412 8-C.P. lamps, being an increase during the year of 13,412 lamps, while signed applications were then in hand for a further 5,000 lamps. The plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The total number of units sold in 1905 was 10,144,995, an increase of 939,653 units. The increase in the revenue derived from these sales has not been correspondingly larger from the fact that in order to meet the severe competition with the gas company, the board decided on making a substantial reduction in the price for lighting, to date as from July 1st last, which means a rebate to the consumers of about £4,000 per annum. The Borough Council's action against the company was, in November last, decided in favour of the company. The plaintiffs have since served notice of their intention to appeal.

Statement of Electricity Generated, Sold, &c., for Year Ending December 31st, 1905.

Board of Trade units generated	10,926,242
Sold to consumers and used by public arc lamps	10,144,995
Used on works for lighting, meter testing, and motors	205,897
Total	10,350,892
Quantity expended in distribution—	
In batteries and motor-alternators	81,898
In feeders	67,388
Transformers	258,700
Total	407,986
Total quantity accounted for	10,758,878
Quantity unaccounted for	167,364
Number of lamps on circuit equivalent in 8-C.P.	120,412

H. W. Sprunt, *Manager and Engineer.*

Scarborough Electric Supply Co.

The annual meeting was held on 3rd inst. Mr. J. E. Ellis, M.P., the chairman, in moving the adoption of the report (see Electrical Review, March 2nd), which recommended the payment of a dividend at the rate of 5 per cent., and the carrying forward of £171, said that with regard to the capital account there had been increased receipts by sales on shares to the amount of £5,106. On the other hand, it was satisfactory to note that the outlay had been £4,636, against no less a sum than £16,368 for 1904, whilst except for normal extensions, the capital outlay might now be considered closed. With the exception of £3,000 remaining to be called up on the list of shares issued, the available capital had been exhausted, but, speaking with care, he did not know that much, if any, of that £3,000 would be required this year. In regard to revenue, a fall of £1,000 in round figures was the weak feature in the year's accounts. The reduction of charges was partly accountable for this, but he thought the policy was likely to bear fruit later in the financial year. As to the expenditure, they had been economising by getting more out of the plant. The net

result was an available balance of £4,909. The report was carried. The retiring directors, the Hon. Charles A. Parsons, C.B., and Mr. J. Bell Simpson, M.Inst.C.E., were re-elected.

City of London Electric Lighting Co.

The directors in their report for 1905, say that the expenditure on capital account during the year amounted to £32,065. This additional expenditure has been made without trenching upon the balance of authorised loan and share capital remaining unissued, which amounts to £194,050. The sum of £89,058 has been deducted from the capital expenditure in respect of buildings, plant and other works dismantled, as further referred to under the heading of "reserves." The capital expenditure consequently stood at December 31st, 1905, at the reduced amount of £2,036,071. The directors have credited the first debenture stock premium redemption account with £1,250 from revenue for interest, and the amount at the credit of the redemption account at December 31st last was £53,331. They have also transferred the sums of £45,000 and £500 from net revenue account to reserve account.

With reference to the following note—

Note.—The original cost of buildings, plant, cables and other works dismantled up to December 31st, 1904, has not yet been deducted from the capital expenditure account,

which appeared in the reserve account for the year 1904, the directors have caused a careful investigation to be made as to the original cost of buildings, plant, cables, and other works dismantled, with the result that they find this cost, as certified by the engineer, amounts to £89,058. They have also had the general stores re-valued, especially as regards old items taken out of service and returned to stores, and have considered it advisable to write down the value by £10,040 to provide for any loss on schedule prices arising on the eventual sale or otherwise. These sums of £89,058 and £10,040 have been debited to reserve account, for which purpose this account was partly created. The balance at credit of reserve account at December 31st, 1905, consequently stood at £196,321; in addition to which there were—first debenture stock premium redemption fund, £53,331; standing reserve for doubtful debts, £1,400; amount carried forward to 1906, £22,235 = total reserves, £273,286.

The total revenue for the year was £263,739. The expenses of generation and distribution were £60,984; repairs and maintenance of buildings, machinery, plant, mains, and other works, £12,721; rent, rates, taxes, management expenses, and special charges, £42,613 = £116,318; interest transferred to debenture stock premium redemption fund, £1,250; staff superannuation fund, £304 = £117,872; leaving £145,867, to which must be added the balance brought forward from 1904, £21,877, making a total available revenue of £167,744; interest on loan from bankers, deposits, &c., absorbed £2,645; interest on first and second debenture stock for the year, £31,825; there has been transferred to reserve account, £45,000; for leasehold redemption, £500, and to suspense account, £2,500; leaving £85,274.

The directors now recommend the full 6 per cent. preference dividend for the year and a total distribution on the ordinary shares of 12s. per share (at the rate of 6 per cent.) for the year. There will then remain to be carried forward to 1906 £22,235. Warrants for the balance dividends will be posted on March 14th.

Private Supply: Average Prices per Unit Obtained.

1899.	1900.	1901.	1902.	1903.	1904.	1905.
5·16d.	4·09d.	4·54d.	4·04d.	3·72d.	3·25d.	2·78d.

The following statements show the position of the company for the last four years:—

Customers and Lamps Connected (Motors included), Private Supply.

	Dec. 31, 1902.	Dec. 31, 1903.	Dec. 31, 1904.	Dec. 31, 1905.
Number of customers being supplied ..	10,998	11,197	11,558	11,960
Number (equiv.) of 8-c.p. lamps connected..	574,188	640,685	727,961	818,955

On February 14th, 1906, there were 862,104 8-c.p. lamps (equivalent) applied for, out of which 834,370 were connected, and the customers numbered 12,042.

Total Units Generated, Sold, Utilised on Works, &c. (Including Public Street Lighting).

	1905.	1904.
Generated	23,121,642	19,966,106
Sold	20,957,648	17,624,110
Metered and used by the company	700,451	668,375
Lost in distribution, &c...	1,463,543	1,673,621
Maximum supply demanded	16,019 kw.	14,943 kw.

Statement of Income for Four Years.

	Dec. 31, 1902.	Dec. 31, 1903.	Dec. 31, 1904.	Dec. 31, 1905.
Gross revenue (after deducting allowances to consumers) ..	£250,667	£242,886	£256,838	£263,739
Net revenue available for repairs and renewals, depreciation, reserve account, interest on debenture stock, &c., dividends and special charges	£149,781	£150,349	£155,399	£157,497

The directors have made provision for the legal and other expenses incurred in promoting the City of London Electric Lighting Co. (Extension of Powers) Bill, and the East London and Lower Thames Electric Power Bill, and in opposing various other Bills in which powers were sought to be obtained affecting injuriously the company's interests, by placing £7,500 to a suspense account, and they propose that the actual amount of these expenses, when finally adjusted, be liquidated out of revenue over a series of three years, commencing with £2,500 in 1905. The directors introduced a short Bill in this Session of Parliament for enabling the company to supply electrical energy for traction purposes to railways, &c., and in bulk to neighbouring authorised electrical distributing bodies.

Several Bills are being promoted this session by other companies and corporations, and the directors are taking steps to protect the interests of this company.

The meeting is to be held on Wednesday, March 14th, at Salisbury House, E.C.

Brompton and Kensington Electricity Supply Co.

The annual report of the directors for 1905 says that the revenue account shows a credit balance of £29,940 which, with the balance of £5,984 brought forward, makes a total of £35,924. After deducting £30 balance of interest, £1,853 for interim dividend on the 7 per cent. cum. pref. shares, and £6,617 interim dividend at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that the sum remaining, viz., £27,424, be dealt with as follows:—

To credit of depreciation account	£8,000
To dividend on the preference shares for half-year ended December 31st	1,836
To dividend on ordinary shares for half-year at the rate of 11 per cent. per annum, making 10 per cent. for the year	8,114
To directors' additional remuneration	791
Carried forward..	8,684
Total ..	£27,424

The following table shows the progress of the company's business during the last four years:—

Year.	Equiv. of 35-watt (8 c.p.) lamps connected.	Increase in 35-watt (8 c.p.) lamps.	No. of customers connected.	Gross receipts.	Expenditure.	Net receipts.	Average price per unit obtained.
1902	137,326	16,114	2,979	£45,655	£19,036	£26,619	5·36d.
1903	154,853	17,527	3,326	£50,273	£21,039	£29,234	4·96d.
1904	169,869	15,016	3,575	£50,189	£21,919	£28,271	4·5d.
1905	188,586	18,717	3,861	£51,149	£21,209	£29,940	4·43d.

The directors record the death of their esteemed colleague, Mr. Robert Arthur Germaine, M.A., K.C., who served the company as a director from its earliest years.

The meeting of the company was held yesterday afternoon.

Chelsea Electricity Supply Co.

The annual meeting of the shareholders of this company was held on Wednesday, February 28th, at Winchester House, Old Broad Street, Mr. J. Irving Courtenay presiding.

In proposing the adoption of the report (see Electrical Review, February 23rd, 1906), the Chairman said that the capital expenditure during the year had been comparatively small. The chief item of £13,138 was mainly the outlay on the extension of the generating station which was commenced at the end of 1904, and which was now about completed. The plant to equip the extension would be added as the demand for the current increased. Expenditure on mains had been small. Notwithstanding that the progress in the past year had not been as great as in the years immediately preceding, they could not regard the position as altogether unsatisfactory. Although the gross takings were about the same in 1904, the net profits were £1,000 more, and while paying £687 more on debentures, which were not fully subscribed until the end of 1904, putting a slightly increased amount to depreciation (£10,918), and with a share issue larger by £25,000—the amount issued in exchange for the founders' shares—they were able to recommend the same dividend as for 1904. The expenses were considerably less than in the previous year partly owing to the fact that in 1904 a special overhauling of the plant and mains, periodically necessary beyond the annual maintenance, was undertaken. Coal was about the same as in 1904, the slight reduction in price amounting only to 2½ per cent. Considering the relative smallness of their output as compared with some of the large electric supply undertakings in London, it was satisfactory to note that their total costs per unit did not compare unfavourably with those of other undertakings more fortunately situated as regarded cheap production of the current. As regarded the future, there were distinct signs of a revival in building operations, and with more activity generally and an improvement in trading conditions, the company should benefit by an increase of custom resulting therefrom. They were very hardly hit by the heavy rates they had to pay, and it would doubtless surprise some of them to hear that 25 per cent. of their divisible profits went in that way. He hoped some united effort would be made in the near future to put local rates on a more equitable footing. The increase in the output during the past year was only small, but it must be noted that there was a remarkable absence of fogs in London in 1905, whereas in the previous year their output was considerably increased in consequence of the prevalence of fogs during the months of November and December. There were several Bills being promoted in Parliament for supply of electricity in bulk, and those they would have to watch closely in order to see that their interests were safeguarded. A great deal of misapprehension had arisen in regard to the benefit which might be derived from these schemes by the individual consumer, and somewhat exaggerated ideas prevailed. He inclined to think that, even should any of the Bills pass, the small individual consumer for lighting would receive comparatively but little benefit. If the prices at which such bulk companies could supply were sufficiently low, they should take a supply from them and save capital expenditure on further extensions, and to that extent both consumers and shareholders would be benefited. At present, however, no price appeared to have been put forward which would justify them in risking a supply wholly from an outside producer. By far

the larger portion of the cost of a supply lay in the distribution expenses, the cost and maintenance of mains, meters and apparatus, the interest on such capital expenditure, and the general supervision and expenses attendant upon dealing with a number of individual consumers. They did not anticipate any harmful competition in their district from the bulk supply companies. Although the use of electricity for heating and cooking purposes was only just commencing, a considerable number of units were sold for this purpose, more especially in the last quarter of the year. Electric radiators had given great satisfaction to many of their customers; and great improvements had lately been introduced in the manufacture of electric cooking apparatus. At the present time it was being tried in some of the large private houses as an adjunct to the ordinary coal-fired kitchen range, and they believed that it would gradually come into more general use, as the advantages of electric cooking became appreciated. The building extension to provide for further machinery at their generating station was now practically completed, and it would be equipped with suitable plant as soon as the necessity arose. The alteration in their system of distribution to which reference was made last year, had given most satisfactory results. The whole of the mains, which were thoroughly examined and overhauled, had stood the increased pressure very well, and the alteration would result in a considerable economy in capital expenditure on mains in the future. As a further result of this change they had been able to dispense with some of the smaller sub-stations, one of which, situated at Pond Place, had been sold. The other sub-stations no longer used for their business, had been let for other purposes.

Mr. William Page seconded the motion, and the report was adopted.

Kensington and Knightsbridge Electric Lighting Co.

The meeting of this company was held at 148, Brompton Road, S.W., on Thursday last week, Lieut.-Colonel R. E. Compton, C.B., presiding.

In moving the adoption of the report (see Electrical Review, March 2nd, 1906), the Chairman said that the directors regretted that they were not able to add to the dividend, the bonus which had been paid for the last two years. In a business such as that there must be considerable fluctuations in earning power, and each reduction in the price charged for energy which it was found necessary to make to the consumers, must be followed by a temporary reduction in the net revenue of the year which followed the reduction. This was the case in the year he had under review, and, unfortunately, it had coincided with several considerable increases in the expenditure, which, however, were not likely to recur. The increase in the output caused by the reduction in price of current and by the general improvement of the district was going on satisfactorily. Many building changes were in progress in the neighboughood, and large blocks of flats, taking a corresponding amount of energy were being put up, so that the prospects as to the future demand seemed to be far greater than they could have hoped for a few years back. The company were maintaining their property and plant in the highest possible state of efficiency. The average price obtained compared very favourably with other districts of London. Parliamentary expenses during the year had been very heavy, and it was due to the aggressive attitude of certain other companies, whose action was regarded as a serious menace to the interests of that company. The question of the directors' fees was one which would be submitted to the meeting later on, but he felt he must address a few words to them on the matter, although it was not pleasant for him to have to do so. The directors considered that up to last year, the remuneration which they had had for their services was inadequate, in view of the fact that the work had doubled and was likely to continue to be very onerous for some time to come. As the matter would come before the meeting, the shareholders could decide for themselves, but one of the shareholders had given notice of motion in the matter. Out of the available balance the directors would be able to pay a dividend at the rate of 10 per cent. per annum on the ordinary shares for the past half-year, making with the interim dividend paid in August, 10 per cent. for the year.

Mr. R. W. Wallace, K.C., seconded the motion.

Mr. Makins, a shareholder, then addressed the meeting on the question of the directors' fees, and said that the directors of other companies were satisfied with smaller fees. For instance, the London Electric Supply Co., with a capital of £1,000,000, gave its directors £1,000; the South Metropolitan Co., with a capital of £417,000, gave its directors £1,113; the Chelsea Co., with a capital of £452,000, gave its directors £1,000; and even the Charing Cross and Strand Co., with a capital of £2,500,000, only gave the directors £1,575; and yet the directors of the Kensington and Knightsbridge Co. seemed to wish to have £1,750.

The Chairman pointed out to Mr. Makins that he had carefully omitted the companies which were paying dividends. No one of the companies he had spoken of was paying a dividend.

Mr. Makins said that he very much questioned the legality of the directors' action.

The Chairman said that the matter was dealt with at the last meeting of the company, and was really settled at that meeting. Mr. Makins's objection had been made since. The work of the directors during the past year had been very hard indeed. He himself had been for 18 days consecutively, in the House of Lords Committee, and there were prospects of the same thing this year. The directors, instead of meriting the action which had been taken, really deserved the sympathy and support of the shareholders.

Sir H. W. Bliss said that he had heard the question of the fall in the price of shares mentioned. That, he thought, was very largely due to the unsettled state of affairs which resulted from the attack of the Administrative County of London Co.

After further discussion, Mr. Makins formally moved his resolution, as follows:—

"That inasmuch as the motion which was carried at the last meeting, when only about a dozen shareholders were present, and of which no notice had been given, to increase the directors' remuneration from £1,000 to £1,750 a year, and to be retrospective as regards the preceding year, appears to have been irregular, if not illegal, it be now rescinded."

This was seconded by Mr. H. S. Saunders, and found one other supporter.

After further discussion, the motion was declared lost on a show of hands.

Mr. Makins then demanded a poll, which was taken, the result being that Mr. Makins's motion was lost by 1,522 votes to 209.

The motion for confirming the increase was then put and carried, and the proceedings terminated with the adoption of the report, and the re-election of Mr. Wallace to the board.

W. T. Henley's Telegraph Works Co.

The meeting was held on Thursday last week at the offices, Blomfield Street, London Wall, Mr. Sydney Gedge presiding.

In proposing the adoption of the report (see Electrical Review, March 2nd, 1906), the Chairman said that might be called the silver wedding year of the company, as it had completed 25 full years of work last December. Mr. Sutton, their energetic and most valuable managing director, joined the company in March, 1881, so that he had been with them exactly 25 years, and it was largely owing to him that the company was rescued from the unfortunate position in which it once was. People who might be inclined to envy them their present position must remember that for the first 11 years they paid no dividend at all, and although they were now paying 15 per cent., that was not on the total capital in the business but only on the ordinary share capital of £200,000. By degrees, as the credit of the company became stronger, they were able to borrow money at cheap rates, and the total amount of capital now in the business, including ordinary and preference, was £550,000. While, therefore, they could congratulate themselves on being able to pay 15 per cent., there was nothing to warrant other people starting against them with any hope of obtaining similar results. Up to the end of 1890, not only had the ordinary shareholders received no dividend, but there was a debit on the profit and loss account of over £50,000. The next year they turned the corner, and had one of the best years in the company's history. They made a profit of over £55,000, and they were able to wipe out all the deficit and carry a small balance forward. In 1892 they paid their first dividend of 5 per cent., and from that date up to the present they had paid in dividends £339,667, and having regard to their small beginnings and the very uphill work which they had for a time, they had every reason to be satisfied. Last year was a record one for the amount of orders received, exceeding as they did by 10 per cent. the highest number they had ever had in any previous 12 months. But although they exceeded in number and amount any previous year, they were not able to obtain the same percentage of profit on them. There was very keen competition for work at the present time, and the profits on orders were, therefore, not so large as they used to be, a fact which rendered economy in administration and management of very great importance. He remembered the times when Mr. Henley, in sending in a tender for a good submarine cable would first put down his cost, add 10 per cent. for contingencies, and then double the amount in order that he might be sure of getting a profit. He was afraid those halcyon days were gone for ever, but notwithstanding that their work continued to increase and they managed to make fair profits. The increase in their business had rendered necessary an extension of their works, and they had bought 12 acres of land at Gravesend where they had erected very fine works indeed. The factory covered an area of more than two acres, and was 700 ft. long × 144 ft. wide, and the whole arrangements for doing the company's work there were about as economical and efficient as one could conceive. The factory would be opened in the course of the following week, and they were going to move into it a considerable portion of the machinery from their Woolwich works. He was pleased to say that up to the end of last week their orders this year represented an amount as large, if not larger, than those which were received by them up to the corresponding period of last year. To pay for the Gravesend works, they had, of course, had to raise additional capital, and last year they obtained power to issue an additional £300,000 debenture stock, of which £150,000 had been raised, and out of that they had repaid the original £50,000 of debenture stock. The new stock was subscribed for seven or eight times over when the books were closed, and all the expense of issuing it had been paid for out of profits.

Mr. George Sutton, the managing director, seconded the motion, and said the year had been one of steady progress, and he was glad to say they had had a fair amount of uniform work, which was the work they liked, as it enabled them to keep all their workpeople going. Not only were their orders last year more in number than ever before, but the turnover was also the largest, and, in view of the increased competition, and also of the fact that the markets for raw material had been against them during the whole of the year, he thought it was a matter of satisfaction

that they had been able to maintain their 15 per cent. dividend without encroaching on the reserve.

The report was adopted.

Metropolitan Electric Supply Co.

The directors' report for the year 1905 states that the capital expenditure, which, at the end of 1904 amounted to £1,539,582, has now reached £1,696,007, being an increase of £156,425. The greater part of this sum was expended in the erection of Fisher Street sub-station and on other works consequent upon the sale of Sardinia Street generating station, and also on further extensions of the system of low-pressure distribution. Towards meeting the above expenditure, some of the securities in which the portion of the Marylebone purchase money representing repaid capital was temporarily invested, have been sold. The sales resulted in a profit of £4,120, which has been carried to a special reserve fund against depreciation of investments generally. The sum of £10,000, being part of the amount awarded to the company for the sale of the Marylebone portion of its undertaking which was paid into court pending the settlement of questions of title, has since been received. After deducting therefrom the cost of certain severance works, and giving effect to the final adjustment of arbitration and other expenses, there remains a balance of £2,649, which has been carried forward for future disposal. A considerable portion of the Marylebone business was taken over by the Borough Council on August 6th, since which date further portions have from time to time been transferred. At the end of the year about one-third of the business remained in the hands of the company. The gross revenue for the year, including that received in respect of the Marylebone business remaining in the hands of the company, amounted to £269,007, as compared with £306,541 in 1904, when the whole of that business was included. There is therefore a decrease of £37,533. The working expenses, which in 1904 were £129,703, amounted in 1905 to £108,725, or a decrease of £20,979. In the last session of Parliament the company obtained powers to supply electrical energy in bulk to authorised distributors and to railway and other companies for purposes of traction in portions of London and Middlesex, full particulars of which are shown on the map accompanying the report. Under these powers a supply of energy is being taken by the Acton District Council, and negotiations are in progress with other councils and companies. The balance at the credit of the revenue account, before providing for depreciation, is £160,283. The directors have set aside £20,000 as an addition to the depreciation and reserve fund, which now amounts to £236,355, carrying to the credit of the net revenue account the sum of £140,283. This sum, with the balance brought forward from last account and other receipts, makes a total of £171,496, of which, after deducting interest on debenture stocks and loans, dividend on preference shares and other charges, including interest paid to the Borough Council of St. Marylebone under the working agreement, there remains a balance of £102,219. An interim dividend of 5s. per share (being at the rate of 10 per cent. per annum) on the ordinary share capital, amounting to £50,000, was paid on August 8th, and the directors recommend that a further dividend of 5s. per share on such shares be now paid, making a total distribution for the year of 10s. per share, or 10 per cent. This will absorb a further sum of £50,000 and leave a balance of £2,219 to be carried forward to the next account. During the year new connections, representing the equivalent of 80,834 8-c.p. lamps, have been added to the company's system, excluding Marylebone, and connections representing 260,524 lamps have been transferred to the Marylebone Borough Council, leaving a total connection at the end of the year, also exclusive of Marylebone, of 607,762 lamps. The stations, machinery and plant have been maintained in a satisfactory condition. It is with deep regret that the board have to record the death of their colleague, Mr. John Verity, who was one of the original directors of the company. It is not proposed to fill up this vacancy at present.

The meeting is to be held on Tuesday next at Winchester House.

County of London Electric Supply Co.

The directors' report for 1905, says that the capital expended during the year under review in respect of the company's London districts amounted to £82,380, making the total expenditure on account of those districts up to December 31st last £1,465,973. The balance brought from last account was £4,852, and the revenue for the year, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, is £91,797, making a total available revenue for the year 1905 of £96,649, from which have to be deducted the following items:—(*a*) Interest on the first and second debenture stock, including interest on instalments paid in advance and interest on temporary loans, £36,367; (*b*) interim dividend on 30,000 6 per cent. preference shares for June half-year, £8,550: (*c*) interim dividend on 40,000 ordinary shares at 4 per cent. per annum for June half-year, £7,600; (*d*) amount carried to reserve for depreciation, repairs, renewals, &c., £20,000 = £72,517, leaving for further distribution, £24,131. The directors now recommend that a further dividend on the 30,000 6 per cent. preference shares, and a further dividend on the ordinary shares at the rate of 6 per cent. per annum for the December half-year be declared, dividends to be paid on March 2nd. This will absorb £19,950, and leave a balance of £4,181 to be carried forward.

The balance of the instalments on the £150,000 4½ per cent. second debenture stock issued in October, 1904, was received during the year. The provisional order granted to the company by the Board of Trade in respect of the district of the Rural District of Croydon was confirmed by Parliament last session. The Bill promoted in the last session of Parliament to confer on the company extended powers, after being modified and passed by Parliament, duly received the Royal assent. The Bill promoted last year by the Administrative County of London and District Electric Power Co. failed to pass the third reading in the House of Commons. A similar Bill is being promoted this year, and the directors have made an arrangement with the promoters which places the company in a favourable position for a bulk supply in the event of the Bill becoming law. With regard to other Bills being promoted in the present session of Parliament, the necessary steps are being taken to protect the company's interests. A contract has been entered into with the London County Council for supply of current for working the electric tramways between Aldwych and Islington pending completion of arrangements for supply from the London County Council's own supply station.

The profits derived from the company's London stations for 1905 amounted to £102,392, against £92,731 for 1904, being an increase of over 10 per cent. for the year, while the percentage of working expenses to revenue from sale of current fell from 45·3 per cent. to 44 per cent. The total applications received at December 31st last amounted to the equivalent of 770,640 8-c.p. lamps, being an increase of 122,929 lamps for the year, as against 118,855 lamps for 1904. Included in these figures are 1,050 users of motors aggregating 9,932 h.p., showing an increase of 2,121 h.p. for 1905, of which 1,000 h.p. is in respect of the Wandsworth station.

The total units sold were 8,614,187, as against 7,181,309 for the previous year. Turbine plant has been erected at both stations during the autumn of 1905, and is now in satisfactory operation. The company has adopted the "Curtis" type of turbine, which effects a great economy of floor space as compared with reciprocating engines. Further extensions with the same type of machinery are now under consideration. Further reductions in the supply charges for both power and lighting were made during the year, which should lead to an increased demand for all purposes.

The Bournemouth and Poole Electricity Supply Co. continues to make satisfactory progress; the directors have recommended a dividend on the ordinary shares of the company at the rate of 7 per cent. per annum for the year 1905.

The Scottish House-to-House Electricity Co., Ltd., has made satisfactory progress during the past year, especially in connection with power supply.

Carlisle Electric Tramways Co.—The annual meeting of this company was held last week at Carlisle, Mr. T. D. Lingard presiding. Mr. Lingard said the cause of the disappointing position was difficult to understand, but trade had not been brisk in Carlisle for some time. The directors proposed to pay a dividend of 1½ per cent, and carry forward £500 to the depreciation account, bringing that fund to £3,651. It was surprising to find that although the cars had run considerably less miles, the amount of energy used had increased by £100. A re-examination of the meters would be made shortly.

Calcutta Electric Supply Corporation.—The number of units delivered to consumers during the four weeks ended January 26th was 274,128 compared with 199,288 units in the corresponding four weeks of the preceding year.

Minehead Electric Supply Co.—The annual meeting was held recently, Mr. J. H. Leather presiding. The profit was £352, the balance brought forward from last year being £23, making a total of £375, the interest on the debentures reducing the total to £311, which it was proposed to deal with by placing £100 to depreciation account (bringing this account to £220), £95 in payment of a 5 per cent. on the £2,000 preference shares, and a like percentage on the £2,000 ordinary shares, carrying forward to the next year's account £21. The report showed that a new engine and suction gas plant of 80 b.h.p., with dynamos coupled direct, had been at work since early in December. Great economy was expected from this mode of generation of current, and the effect produced was appreciable.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in:—

Sir Hiram Maxim Electrical Co., Ltd.—7,362 6 per cent. cumulative preference shares of £4 each, fully paid, Nos. 1 to 7,362.

And to allow the following securities to be quoted in the Official List:—

Chelsea Electricity Supply Co., Ltd.—Further issue of 5,000 ordinary shares of £1 each, fully paid.

Direct Spanish Telegraph Co.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, a dividend at the rate of 4 per cent, free of income-tax, on the ordinary shares, both for the half-year ended December 31st, 1905, and payable on April 2nd, 1906.

Davis & Timmins.—The directors recommend a dividend of 8 per cent. for the year 1905. The 1904 dividend was at the same rate.

Hadfield's Steel Foundry Co.—The directors recommend a final dividend of 2s. per share and a bonus of 1s. 6d. per share. This makes a total dividend for the year of 22½ per cent This is the same rate as for 1904.

The directors, instead of [illegible] taken, really deserved the sympathy and support of the shareholders.

that the markets for raw material had been against them during the whole of the year, he thought it was a matter of satisfaction

MARKET QUOTATIONS.

Wednesday, March 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£15	£2 inc.
a Benzole (90 %)	per gal.	10½d.	..
a ,, (50 %)	per gal.	10d.	..
a Copper Sulphate	per ton	£24 10	..
a Lead, Nitrate	per ton	£25	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a Potassium Bichromate, in casks	per lb.	3d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	200/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	2½d.	..
a ,, Cyanide	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£160	..
b ,, Wire, in ton lots	per ton	£191	..
b ,, Sheet, in ton lots	per ton	£177	..
b Babbitt's metal ingots	per ton	£43 to £140	..
c Brass (rolled metal 2' to 12') basis	per lb.	9d.	..
c ,, Tube (brazed)	per lb.	10½d.	..
c ,, ,, (solid drawn)	per lb.	9⅞d.	..
c ,, Wire, basis	per lb.	8⅞d.	¼d. dec.
c Copper Tubes (brazed)	per lb.	11½d.	..
c ,, ,, (solid drawn)	per lb.	11⅝d.	..
g Copper Bars (best selected)	per ton	£93	..
g Copper Sheet	per ton	£93	..
g ,, Rod	per ton	£93	..
e ,, (Electrolytic) Bars	per ton	£92	..
e ,, ,, Sheets	per ton	£104	..
e ,, ,, Rod	per ton	£95	..
e ,, ,, H.C. Wire	per lb.	11d.	..
f Ebonite Rod	per lb.	3/3	..
,, Sheet	per lb.	3/-	..
n German Silver Wire	per lb.	1/7	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	5/3½ to 5/4½	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	47/5½	1/4 dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£16 5 to £16 7 6	7/6 dec.
g ,, ,, Sheet	per ton	£18 10 to £18 12 6	7/6 dec.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot	£7 7 6	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/3	..
p ,, rolled bars & rods	per lb.	1/1½ to 1/3	..
p ,, ,, strip & sheet	per lb.	1/4	..
o Platinum	per oz.	91/6	..
e Silicium Bronze Wire	per lb.	1/- to 1/1	inc.
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£163 10 to £164 10	60/- to 70/- dec.
n ,, Wire, Nos. 1 to 16	per lb.	1/11	..
p White Anti-friction Metals— "White Ant" brand	per ton	£46 to £70	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5⅜d.	..
j ,, 3 ply 10 lbs. Russian	per lb.	4½d.	..
j ,, 10 lbs. Russian, single	per lb.	4¼d.	..
j ,, 180 lbs. Jute rove	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£28 15	35/- dec.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd. James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
j Walter H. Hindley & Co., Ltd.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Fatality.—While engaged by Messrs. Selby, Bigge and Co. in the erection of electrical plant at the Aberbaiden Colliery, an electrical engineer named Robert Graham Little, aged 27, met his death through the falling of an arch which was being built for the roof of the engine house.

London United Tramways (1901), Ltd.—The meeting of this company was held at Chiswick on Monday. The chairman made in his speech some interesting observations on the subject of depreciation. The report was adopted. Our account of the proceedings will appear next week.

STOCKS AND SHARES.

Wednesday Evening.

Money gives signs of becoming cheaper, but general business is no brisker, in the Stock Exchange. Those who used to sneer at a stockbroker because of the popular idea that to him expense was no object, have perforce changed their tone to one of greater sympathy—they take him to lunch sometimes. But in the electrical sections, the dealers admit that they "keep going," and even the fall in supply shares has, to some extent, encouraged business, although of a sort that is doubtfully useful. Telegraph stocks, too, are firm, and the manufacturing division continues to display strength. British Electric Tractions have fallen heavily.

Amongst the electricity supply shares, Westminsters are flat with a drop of 12s. 6d., to 10½, the report being read with dissatisfaction. St. James' are even worse, with a drop of 30s., to 9½. Yet Westminster Preference at 5 9/16 are 1/16 better. Brompton Ordinary at 9 have improved 5s., and County of Durham ½, while Hove Ordinary advanced to 8¾. Charing Cross and Edmundson's both fell 5s., the market in each being depressed by constant sales, though of fairly small lots. The continued decline in prices makes it necessary to revise our previous list of yields to be obtained from investment in supply shares. As the dividends of the metropolitan companies are now all declared, we supplement our figures of last autumn with the following table, bringing the calculations up to date. We take, of course, the Ordinary shares, and in a second column give the change in the dividend for the past year as compared with the preceding twelvemonth:—

Company.	Dividend per cent., 1905.	Increase or decrease.	Price.	Yield on money.
Brompton	10	—	9	£5 11 0
Charing Cross	5	—3	5	5 0 0
Chelsea	6	—	5½	5 9 1
City of London	6	—	11½	5 6 8
County of London	5	+½	9	5 11 0
Kens. and Knightsbridge	10	—2	10	5 0 0
London Electric	4	+1	2⅝	4 11 5
Metropolitan	10	—	9	5 11 3
Notting Hill	7½	+½	14	5 7 2
St. James'	12½	—2	9½	6 11 7
South London	4	—	3⅝	5 14 4
South Metropolitan	2½	+2½	15/16	3 1 6
Westminster	13	—1	10½	6 3 10

How long is it, we are tempted to wonder, since electric shares in the front rank, such as Westminsters and St. James', could be bought to pay more than 6 per cent. on the money invested?

With admirable quietness, the Marconi Wireless Telegraph Co. is making preliminary arrangements for a new issue of capital. We learn at the same time, but in a much less confidential manner, that it is hoped to pay a maiden dividend this year; that it will be possible to cable before long to America at a cost of sixpence per word; that by a new development of the system, a ship will be able to be located within an immense radius without other vessels being affected. To get back to firmer ground, it may be observed that of the authorised share capital of half a million little more than 50 per cent. has so far been issued. The recent sudden slump in the price of the shares is, of course, explained by this reported intention of the directors to raise fresh capital. Stock Exchange wireless telegraphy is sometimes less uncertain in its action than the other kind. In preparation, the price has been advanced to 1¼, a rise of half-a-crown.

Anglo-American Telegraph stocks are a trifle easier, no doubt because of the prospect of sixpence a word competition! Direct Spanish Preference shares and Debentures are both better, and Direct United States Cable shares have further risen to 15½. In the Eastern group, a fall of a pair of points reduced Eastern Ordinary to 148½. National Telephone Deferred is ½ better, but the First Preference lost the same fraction, upon some doubts as to how the shares are likely to be treated in the day of reckoning.

Buyers came forward for Metropolitans and Districts after the severe drop, and the result is seen in the recovery to 79 in the former, and to 30½ in Districts. Breakdowns, however, continue to occur on both systems with an industry that would do credit to any nigger minstrel troupe. Central London Ordinary lost 1, and, with the approach of summer already heralded in this balmy atmosphere, the tube railways are sure to feel with growing acuteness the rivalry of the motor-omnibus companies, whose shares, by the way, are advancing after their late drop. The Manchester District affair was best left alone.

At the meeting of the London United Tramways Co. the other day, promises were made that the reserve fund should receive more consideration in the future, a prospect that does not excuse the misdeeds of the past. The Debenture stock is lower at 93½. Calcutta Trams hardened ½, Belgranos went ¼ lower, and Potteries Ordinary and Preference lost 10s. each in sympathy with the slump in British Electric Tractions, which are down as low as 6½, the Preference also falling to 9¾. Rumour is already busy with the dividend outlook for the Ordinary shares next June, and a low distribution is talked of. Meanwhile the public take no interest whatever in the shares, except to sell.

British Aluminium Preference have been put up ¼ to 6, and a little demand for Westinghouse Debenture lifted the price 2 per cent. to 82½. The company has just secured a good contract for more County Council tramway work. Beyond these alterations the Miscellaneous list is colourless.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905.	Closing Quotations Feb. 28th.	Closing Quotations March 7th.	Business done week ended March 7th, 1906. Highest	Lowest.	Rise + or Fall —
17,700	African Direct Telegraph, 4 % Debs.	100	4 %	4 %	4 %	4 %	98½—101½	98½—101½	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3⅞— 4¼	3⅞— 4¼	..	..	..
155,600£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	5 %	83 — 88	83 — 88	..	..	..
702,600	Anglo-American Telegraph	Stock	60/6	61s.	2⅝%	3½%	65 — 67	65 — 67	..	..	..
3,148,700	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5½%	6 %	113½—114½	113 —114	113⅝	113	— ½
3,148,700	Do. do. do. Deferred	Stock	1/-	2s.	Nil	1%	18¼— 19¼	18½— 19	19	18⅛	— ⅛
50,000	Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red.	100	..	..	..	..	103 —105	103 —105	..	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	8 — 8¼	8 — 8¼	8⅛	..	..
1,932,856£	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	97½ — 98½	97½ — 98½	98⅛	57½	..
16,090	Cuba Telegraph	10	6½%	10 %	5 %	5 %	8⅝— 9	8¾— 9	8⅞	8⅞	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %	17 — 18	17 — 18	..	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼— 8⅝	8¼— 9	..	..	+ ⅛
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —102	100 —103 %	..	..	+1
60,710£	Direct United States Cable	20	3½%	3 %	3½%	3⅜%	15 — 15½	15½— 15⅝	15⅝	15⅜	+ ⅛
70,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 %	149 —152	147 —150	150¾	148¾	—2
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	91 — 93	91 — 93	92¼	91	..
1,848,772	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	107⅛—109½	107⅛—109½	109	108	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	6 %	14⅜— 15⅝	14⅜— 15⅝	15⅝	15	..
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	106¾	..	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99¾	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	101 —103 %	..	..	..
180,887	Globe Telegraph and Trust	10	£3	5½%	5⅝%	5 %	11¼— 11⅝	11¼— 11⅝	11⅞	11¼	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	14⅜— 15	14⅜— 15	14⅝	14⅜	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	37½— 39½	37½— 39½	..	..	..
42,300	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	5 %	57 — 59	57 — 59	..	..	..
251,127	Marconi's Wireless Telegraph	1	..	..	..	..	1 — 1⅛	1⅛— 1⅛	22/6	..	+ ⅛
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	3 %	3 %	4 %	..	¾— 1	¾— 1	19/3	..	..
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	¾— 1	¾— 1	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	114 —115	114 —115	114¾	114	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %	110 —112	111 —112	111⅜	111⅛	..
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	13 — 15	12½— 14½	14¼	13	— ½
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	12⅛	11¼	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅞	5½— 5⅝	5⅝	5⅜	— ⅛
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	99 —101	99 —101	..	..	..
1,689,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	104½	103½	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6⅝%	6 %	1¼— 1⅜	1¼— 1⅜	25/3	..	..
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	..	4 %	97 — 99	97 — 99	98¾	98	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	99 —102	99 —102	97⅞	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	5 %	7½— 7¾	7½— 7¾	..	..	..
60,000	Telephone Co. of Egypt, 4½ % Deb. Red. ..	100	..	..	..	4½%	103 —106	103 —106	..	..	..
3,201	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..
70,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7¼— 7½	7¼— 7½	..	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜— 5½	5⅜— 5⅝	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	110 —112	110 —112	..	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	9½— 10	9½— 10	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅝— ¾	⅝— ¾	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101¼	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	5 %	14½ — 15	14½ — 15	14⅝	14½	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..
663,380	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	103¼	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	8/9	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	6 %	8¼— 8½	8¼— 8½	8⅜	8⅛	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	6½— 7½	6½— 7½	..	..	..
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

170,000	Anglo-Argentine Trams, 260,008 to 430,007	5	..	..	8 %	6 %§	8½— 9⅛	8½— 9⅛	8⅝	8⅞	..
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	..	5 %	5 %	5½%	5⅝— 6⅛	6 — 6⅛	6	6	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	141 —144	141 —144	..	..	..
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	..	5 %	5 %	5 %	104 —106	104 —106	105⅛	104½	..
800,000	Babcock & Wilcox, 1 to 590,000	1	..	17 %	20 %	16 %‖	3⅞— 4⅛	3⅞— 4⅛	82/6	80/7½	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	..	6 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	49/9	..	..
38,000	British Aluminium, Ord., 2,001 to 40,000	5	..	..	..	..	2 — 2¼	2 — 2¼	45/-	..	..
40,000	Do. do. 7 % Cum. Pref...	5	Nil	Nil	Nil	3/6	5¼— 6	5¾— 6⅛	6¼	5⅞	+ ⅛
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	3/-	5 — 5½	5 — 6¼	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅜— 2½	2⅜— 2½	..	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	98 —102	98 —102	..	..	..
800,000	British Columbia E. Rail Def. Ord. Stock ..	100	..	6 %	6 %	..	120 —123	120 —123	..	..	..
300,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	..	110 —113	110 —113	110½	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	..	5 %	5 %	5 %	108 —111	108 —111	..	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	103 —105%	103 —105 %	..	..	..
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	102 —105	102 —105	104⅜	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	7⅜— 7⅝	6 — 7	7⅛	6⅞	—1⅛
161,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %§	10 —10⅜	9⅞— 10⅛	10 1/16	9⅞	— ⅛
1,415,422£	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	119 —121	117 —120	120⅛	119	—2
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	4½%	98 —100	98 —100	98¾	..	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %§	6¾— 7	6⅞— 7⅛	7	..	+ ⅛
100,000	Do. do. 6 % Cum. 1st Pref.	5	6 %	6 %	6 %	6 %§	5¾— 6¼	5¾— 6¼	6 1/16	6 1/32	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	..	4½%	4½%	4½%	98 —100	98 —100	..	..	..
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	1⅞— 2⅛	1⅞— 2⅛	48/9	41/3	..
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	..	4 %	4 %	4 %	78 — 83	80 — 85	82½	..	+2
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1⅛	⅞— 1⅛	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	⅜— ½	⅜— ½	15/7½	15/3	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1⅝— 2	1⅝— 2	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	97 — 99 xd	97 — 99	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	82 — 84	82 — 84	..	..	..
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	..	3⅜— 3⅝	3¼— 3⅜	74/4½	73/9	— ⅛
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	..	5¾— 6⅛	5¾— 6⅛	..	..	..
27,500	Do. "B" do. 1 to 27,500	5	..	6 %	6 %	..	5¼— 5⅞	5¼— 5⅞	5⅝	..	..
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	105 —107	106 —108	..	..	+1
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	102 —105	102 —105	..	..	..
105,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	7 %§	9½— 10	9⅝— 10⅛	10	9 1/16	+ ⅛
32,610	Do. 105,001 to 137,610	5	..	..	..	3d.	9 — 9⅛	9 — 9⅛	..	..	..
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4 %	4½%	105 —107	106 —108	..	..	+1
35,000	Callender's Cable Construction shares ..	5	15 %	12½%	12½%	10%	11 — 12	11 — 12	..	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¾— 6	5¾— 6	5⅞	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108¾—110½	108¾—110½	..	..	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %§	⅜— ½	⅜— ½	..	..	..
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	..	1 1/16— 1 1/16	1 1/16— 1 1/16	22/-	..	..
230,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	95 —100	95 —100	..	..	..
1,939,698	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	91 — 93	92	91	—1
530,316	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	104½	..	..
530,316	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	82⅜	81½	..
1,480,000	City and South London Railway	Stock	3½%	2⅞%	2¾%	1⅞%	41 — 43	41 — 43	42½	42	..
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	2½%	2½%	..	2 — 2¼	2 — 2¼	..	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98 %	..	..	..

▲ period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

(Continued on next page.)

subject of depreciation. The report was adopted. Our account of the proceedings will appear next week.

Miscellaneous list is colourless.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	§1905.	Closing Quotations Feb. 28th.	Closing Quotations Mar. 7th.	Business done week ended Mar. 7th, 1906. Highest.	Lowest.	Rise + or Fall−
52,000	Dick, Kerr & Co., 1 to 52,000	† 5	..	..	10 %	..	8¾ — 9¼	8¾ — 9¼	9 1/16	..	..
61,000	Do. do. 6 % Cum. Pref., 1 to 61,000	5	..	6 %	6 %	6 %	6 — 6½	6 — 6½	..	..	..
294,150	Do. do. 4½ % Deb. Stock	100	..	4½ %	4½ %	4½ %	104 —106	104 —106	..	..	..
60,000	Dublin United Trams. (1896), 1 to 60,000	10	..	5½ %	6 %	6 %	13¾— 14¾	13¾— 14¾	..	..	..
59,987	Do. 6 % Pref. between 1 and 60,000	10	..	6 %	6 %	6 %	14½— 15½	14½— 15½	..	..	..
63,400	Do. 4 % Debs.	100	..	4 %	4 %	4 %	99½—100½	99½—100½	..	..	..
300,000	Do. 3½ % "A" Deb. Stock	100	..	3½ %	3½ %	3½ %	99 —101	100 —100½	..	..	+ ¼
300,000	Do. 3½ % "B" Deb. Stock	100	..	3½ %	3½ %	3½ %	97 — 98	97 — 97½	..	..	— ¼
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	2½ §§	..	1⅝— 1⅞	1⅝— 1⅞	36/10½	35/7½	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	2½ §§	..	2½ — 3	2½ — 3	..	..	..
844,023	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..
100,000	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	92 — 97	92 — 97	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	⅜— ½	⅜— ½	13/9	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	2 — 2½	2 — 2½	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9¼— 9½	9¼— 9⅜	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	95 — 99	95 — 99	..	..	..
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	..	3 %	4 %	4 %	4¼— 5	4¼— 5	93/9	..	..
96,000	Greenwood & Batley 7 % Cum. Pref.	10	..	7 %	7 %	7 %	10¾— 11¼	10¾— 11¼	..	..	..
80,000	Do. do. 5 % Mort. Debs.	100	..	5 %	5 %	5 %	102 —104	102 —104	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	15%	13 — 14	13 — 14	13⅜	13⅜	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5¼— 5½	5¼— 5½	5 1/8	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	.. — ..	.. — ..	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10 %	5 %	10%	18 — 19	18 — 19	18¼	18⅜	..
800,000	Do. do. 4% 1st Mort. Deb.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1⅞%	1½%	Nil	1⅜— 1⅞	1⅜— 1⅞	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6½— 7	6½— 7	..	..	..
600,070	London United Trams (1901), 1 to 50,007	10	..	8 %	6 %	3 %	9 — 9¼	8 — 9	..	..	— ¾
399,930	Do. do. 60,008 to 100,000 (£4 paid)	10	..	8 %	6 %	3 %	3 — 4	2½— 3½	..	..	— ¾
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	..	5 %	5 %	5 %	9 — 9½	9 — 9¼	9 1/8	9¼	..
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	93 — 96	92 — 95	95¼	93½	—1
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	..	7/16— 9/16	7/16— 9/16	..	..	..
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1⅛— 1 1/16	1⅛— 1 1/16	..	..	..
350,000	Do. 4½ % Deb. Stock Red.	100	..	..	4½%	4½%	104—106	104 —106	104½	104½	..
20,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	5	..	..	6 %	6 %	4⅜— 5¼	4⅜— 5¼	5 1/8	..	..
24,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	10	..	5 %	5 %	..	8½— 9¼	8½— 9	8 1/8	8⅛	— ¼
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	..	5 %	5 %	5 %	9½— 10	9¼— 9⅝	9⅜	..	— ¼
245,000	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	103 — 106	103 —106	..	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	15 %	34 — 36	34 — 36	35½	34	..
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
8,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	..	5 %	98 — 100	98 —100	98⅜	98⅜	..
540,000	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3½%	101 — 104 xd	101 —104	101½	101	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	8½%	6 %§	..	..	2¼— 2⅜	2¼— 2⅜	47/6	45/-	..
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	..	..	4 — 4½	4 — 4½	81/3	80/9	..
246,806	Do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	82 — 87	82 — 87	85	84½	..

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	..	5 %	5½%	4 %§	5½— 5⅝	5½— 5⅝	..	..	..
50,000	Do. do. 4½ % 1st. deb. stock	100	..	4½%	4½%	4½%	103 —106	103 —106	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	10 %	8½— 9½	8½— 9½	8 1/8	8⅜	+ ¼
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8⅝— 9¼	8⅝— 9¼	..	..	..
300,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	102 —105	102 —105	104	..	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	5 %	5 — 5⅛ xd	4⅞— 5⅛	5 1/16	97/6	— ⅛
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	4⅞— 5⅛	98/9	..	— ⅛
40,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	90/-	..	..
40,000	do. 1903	5	..	4½%	4½%	4½%	4⅛— 4⅜	4⅛— 4⅜	..	..	..
420,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..
44,436	Chelsea Electricity Supply, Ord.	5	5½%	5½%	6 %	6 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108 —110	108 —110	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	6 %	10⅜— 11⅜	10⅜— 11⅜	11 1/16	..	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	13½— 14½	13½— 14¼	13 7/16	13½	..
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	123 —126	..	..	..
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..
40,000	County of Durham Electrical Power, Ord.	2	4 %	4 %	£3 7 0	4 %	1⅜— 2	1⅞— 2⅛	..	..	+ ⅛
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½ %	5 %	8¾ — 9¼	8½ — 9¼	8 1/8	..	..
80,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	12⅜— 12⅝	12⅜— 12⅝	12 1/8	12½	..
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	109 —112	109 —112	110⅛	..	..
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	102⅛	102	..
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	5 %§	4½— 5	4⅜— 4½	90/-	87/6	— ⅛
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	6 %	5⅞— 5⅞	5⅛— 5⅜	5 1/16	5⅛	..
320,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	104 —106	104 —106	105⅛	104⅛	..
10,000	Folkestone, 1 to 10,000	5	..	5½%	5½%	4 %§	5⅜— 5⅝	5⅜— 5⅝	..	..	..
10,000	Do. 6 % Cum. Pref., 1 to 10,000	5	..	..	..	5 %	5 — 5⅛	5 — 5⅛	..	..	..
75,000	Do. 4½ % 1st. Deb. Stock	100	..	4½%	4½%	4½%	101 —104	101 —104	..	..	..
13,000	Hove, 1 to 13,000	5	..	8½%	8½%	9 %	8⅛— 8⅜	8⅛— 9	8½	..	+ ¼
10,000	Do. New (£5 10s. paid)	£3	..	8½%	8½%	9 %	8¼— 8⅜	8¼— 8⅜	..	..	..
37,300	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	98 —101	94 — 97	..	..	— ¼
7,300	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	98 —101	96 — 99	..	..	—2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12%	12 %	10 %	9½— 10⅛	9⅛— 10⅛	..	..	..
90,000	Do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	4 %	2⅜— 2⅝	2⅜— 2⅝	..	..	..
60,000	Do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	5⅜— 5⅝	5⅜— 5⅝	..	..	..
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	99⅛	..	..
200,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8⅜%	10 %	10 %	9 — 10	8⅛— 9⅛	9 1/8	9	— ⅛
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	4½%	5⅜— 5⅝	5⅜— 5⅝	5 1/16	..	..
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	110 —114	110 —114	..	..	..
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	95 — 97	95 — 97	96	95½	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	101 —103	101 —103 %	..	..	..
57,009	Newcastle-on-Tyne, 1 to 57,009	5	..	8 %	8 %	8 %	8 — 8⅛	8 — 8⅛	..	..	..
17,991	Do. 57,010 to 75,000	5	..	..	..	8 %	8 — 8⅛	8 — 8⅛	..	..	..
57,009	Do. 5 % Pref., 1 to 57,009	5	..	5%	5	5 %	6¼— 6⅜	6¼— 6⅜	..	..	..
17,991	Do. 57,010 to 75,000	5	..	..	..	5 %	6¼— 6⅜	6¼— 6⅜	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	7⅞%	13⅜— 14⅜	13⅜— 14⅜	..	..	..
64,000	Do. do. 4 % 1st Mort.Deb...	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..
18,500	Oxford, 1 to 96 and 407 to 18,810	5	..	6¼%	7 %	7 %	6¾— 7	6¾— 7	..	..	..
50,000	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	99 —101	99 —101	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	12½%	10⅜— 11⅜ xd	9 — 10	9¾	..	—1⅛
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8 xd	7 — 8	..	..	..
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	97 — 99	97 — 99	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	4 %	2⅜— 2½ xd	2⅜— 2⅝	49/4½	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	1½%	3 %	4 %	4 %	3½— 3¾	3⅜— 3⅝	..	..	..
103,700	South Met. Elec. Lt. & Power (Ord.	1	Nil	Nil	Nil	2⅜%	7/16— 8/16	7/16— 8/16	..	..	..
85,368	*(Late Blackheath and Greenwich* (7 % Pref...	1	Nil	7 %	7 %	7 %	1⅛— 1⅜	1⅛— 1⅜	26/9	..	..
148,292	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..
50,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	4¼— 4⅜	4¼— 4⅜	90/-	87/6	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	5 1/16	5 3/32	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	4½%	104 —106	104 —106	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13 %	10⅜— 11⅛	10 — 11	10⅜	10 1/16	— ⅜
28,151	Do do. 4½ % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5 1/16— 5 1/16	5 1/32	5 1/16	— 1/16

Shares not officially quoted :—Mackay Companies, ord., 61½—62½. Pref. 76—77.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

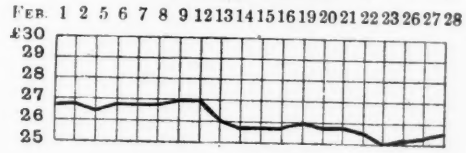
Bank rate of discount 4 per cent. (September 28th, 1905).

(Continued on next page.)

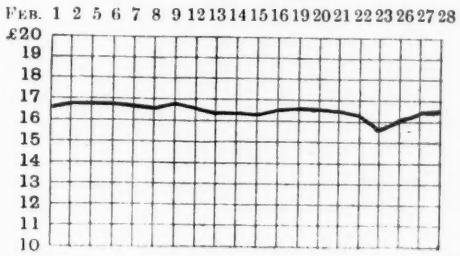
METAL MARKET.

Fluctuations in February.

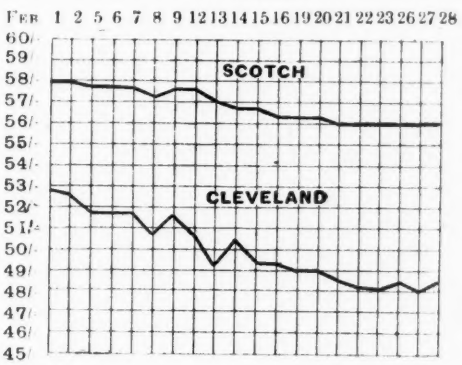
SPELTER (G.O.B's.)



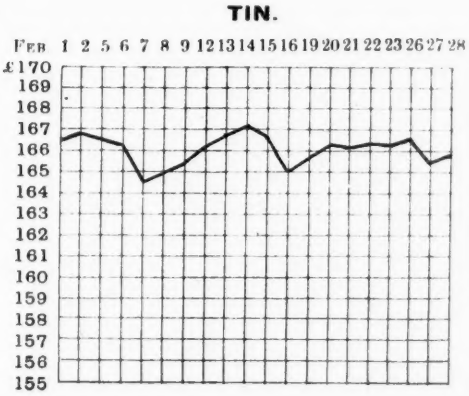
LEAD (ENGLISH)



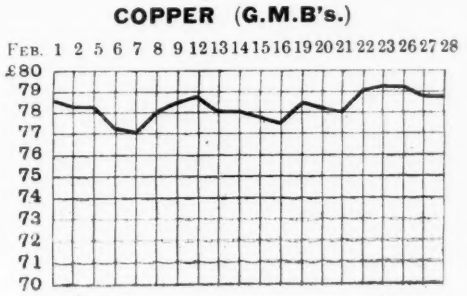
IRON.



TIN.



COPPER (G.M.B's.)



PROCEEDINGS OF INSTITUTIONS.

Notes on the Construction and Maintenance of Overhead Equipment.

By Robert N. Tweedy, Associate Member, and H. Dudgeon.

(*Abstract of Paper read before the* Institution of Electrical Engineers *at Birmingham, February 14th*, 1906.)

As a matter of practical fact, great danger has never attended the fall of a trolley wire; vital statistics show that there have been no more than four fatalities due to the presence of overhead construction in our streets, and of those four the Liverpool accident accounts for two.

The real danger, however small it may be, as every tramway engineer will admit, has lain, and still lies, in the fall of message wires, and of the guard-wires which are placed compulsorily between the trolley-wires and those message wires.

Undoubtedly guard-wires have been of some service in the intended direction; while once at least they were the means of keeping the cars running over a stretch of line which else had been severed as to its negative side from the power station. They manfully bridged the gap which a thoughtless permanent-way foreman had made in the rails. Many instances have come under notice in which careless driving, or a defect in the overhead work, or in some part of the trolley, has resulted in the heavy cast-iron trolley standard being snapped in two after fouling the trolley-wire, while the overhead construction has not appeared to be damaged in the least, although the commotion among the poles has been fearful to behold. Fortunately that kind of accident has been reduced to a pleasant infrequency, to be ascribed largely to the calm influence of the Board of Trade, which called for detailed monthly reports of accidents of this nature (among others), and insisted on the adoption of the best-known precautionary measures. If the excursion of trolley poles amongst the trolley and guard wires can be written down as "practically impossible," the plea for lighter construction which is made later in this paper will be given much greater weight. The number of such accidents is ever on the wane, and the general use of the retrieving devices, of which there are several on the market, would bring it down to as near zero as we may expect to get.

While the capital cost of tramways in Great Britain runs between the extraordinarily wide limits of £10,000 and £24,000 per mile of single track, the cost of overhead equipment may be taken as varying, equally widely, between £700 and £2,000 per route-mile.

It is highly desirable that every nerve should be stressed to reduce the cost of each portion of a tramway, and it is one of the chief objects of this paper to elicit discussion as to the best means of effecting this end with relation to the overhead construction.

Poles.—We disagree so much with those who say that the British Standard poles are too light, as to assert that they can be made lighter without sacrificing safety or any other desirable quality.

The tendency during recent years has been all in the direction of increased strength and, therefore, weight of poles, while it seems to us, at least, that the greater cost entailed is not warranted. For instance, a certain line was constructed under three contracts. One length of three miles is all span wire, and the poles are 29 ft. to 29 ft. 6 in. long, built up of three sections 6½ in. × 5½ in. × 4½ in., out of steel ¼ in. thick. Another equal length has poles 31 ft. × 7½ in. × 6½ in. × 5½ in. × ½ in. for all straight-line work, whether span, side-bracket, or centre-bracket construction; while the third contains centre, side-bracket and span poles which are all taper 6½ in. × 4½ in. × ⅜ in. Here we have poles of very different sizes doing the same work under the same conditions, and the smallest stand up just as straight as the others. All the sizes cannot be right, and it is plain that, if they are all satisfactory, the smallest is economically the best.

Then we may take Bristol and Dublin, where as many as five different sizes were used in the original construction (P. Dawson), the smallest of them having to stand a lateral strain near the top of 350 lb., and the others 500, 700, 1,000 and 2,000 lb. respectively. The last size may be left out of consideration of the general problem, as it is used for anchoring purposes only. That leaves the 350-lb. pole for the lightest work, the 500 for longer brackets and for straight-line spans, the 700 for somewhat similar duty and for heavier spans and light curves, while the 1,000-lb. pole would be left for all but the heaviest curves and anchorages.

As tramways have increased, the three light sizes have dropped out almost entirely, and engineers begin now with something like the 1,000-lb. pole.

The Americans have to stand a deal of blame for our faults, and we believe that our predilection for heavy poles is due in great measure to that nation. Linesmen came over to put up our lines for the American contractors who did most of the work for the first few years, and the hasty, shoddy work to which the men were accustomed led them to believe that a foot of rake was none too much, unless the hole was got out of solid rock, in which case 6 in. might be enough. Such rakes were used regularly, and are put in to this day by many linesmen. In our careful British way we used to give the constructional linesmen spring dynamometers to put in series with the pull, but they broke when this exceeded 600 or 700 lb., and the rest of the rake was removed without the aid of an indicator. It may be imagined what a bad reputation was given to the lighter poles—a reputation which has led finally to the standardising of poles which are too heavy.

If engineers could persuade themselves that 18 in. sag in a 30-ft. span and 2 ft. across a 40-ft. road is neither unsightly nor detrimental, and would insist that the span-wires are not pulled up any more than that, they would find the light poles which they

† Unless otherwise stated all shares are fully paid. ‡ Interim dividends.

Bank rate of discount 4 per cent. (September 28th, 1905).

have cast aside, strong enough for 75 per cent of the construction, allowing heavier poles for curves and the like on 25 per cent. of the line. In average ground, with ½ yd. or so of concrete round the pole, 1 in. to 2 in. is quite enough rake to allow when setting.

Assuming that the South Staffordshire poles are too light to be safe even for bracket-arm work, what a gulf there is between their 450 lb. and the 1,000 to 1,500 lb. of the poles now in most common use. Then consider that a pole which is too light for a 10-ft. bracket arm may be quite big enough to divide with another the weight and other stresses of a 30-ft. span.

For the average width of street the 500 lb. (lateral strain for 6 in. deflection) pole mentioned in connection with Bristol and Dublin, is heavy enough for straight-line work if used in the proper manner. It is not unreasonable to estimate that a saving of £200 per route-mile can be made by following this advice.

The height of all the standard poles is 31 ft., but there are many instances, which will increase as the use of guard-wires declines, where shorter poles would be as good. That is eminently the case in centre-pole and light bracket-arm work, where it is unnecessary to bury 6 ft. of the pole, and, indeed, we have found a depth of 5 ft. sufficient in straight line spanwork of average weight.

Concrete.—When poles are subjected to less strain, the quality of the concrete setting may be reduced. This costs at present about 9s. per pole for labour and material, and it is usual to find that one bag of Portland cement is allowed per pole. This charge may be brought down to 5s. or 6s. with equal results, and, even with excessive tension on the span-wire, half a bag of cement has been found enough. Naturally, the materials for the poorer concrete must be good; the broken bricks, stone, slag or gravel, clean and wet: the sand sharp and clean, and the whole mixed thoroughly and allowed to set for a week or more.

Bases.—A cast-iron base on a tramway pole is of as much use as a diamond ring on a lady's finger. Something which breaks with comparative ease is set to protect another thing so firmly embedded and so stoutly made, that any accident which displaced or broke it certainly would not be averted or mollified by the presence of a cast-iron base.

Not only is the base no good, it actually produces expense. After a pole is erected and the base is in its place, the invariable practice is to clean both and to give them two or three coats of good paint; and if they are to be kept in condition another coat must be given every year. The pole under the base does not even get the first attention, soon loses what remains of its "shop" coat after the rough treatment of erection, and peels off skin after skin of oxide. True, this part of the pole is not exposed to the weather like its more fortunate remainder, but it is exposed to atmospheric moisture, and with serious results.

An average base costs from 15s. to 20s., depending on its weight and ornamentation. Many corporations have gone in for bases 5 ft. and 6 ft. high, decorated profusely with arms and all kinds of pretty designs; but we may leave these out of the question as wilful extravagances, and assume that the average base weighs from 300 lb. to 450 lb.

If this luxury were relinquished it would make a difference of at least £45 per mile of route for bases alone, excluding materials and labour for caulking, and cost of extra labour and carriage entailed by their presence. Probably the best part of £100 per route-mile would be saved as an average over the whole kingdom.

Ventilation.—If bases are not to be given up, let them at least be drained and ventilated, and if possible let them be designed and erected so that they may be lifted out of the way, to allow the hidden part of the poles to be painted. It is better to steady and centralise the base with distance pieces cast on, than to do any caulking, so leaving a passage for air and water. The water must be drained off, and that is facilitated if the concrete setting of the pole is raised in the shape of a cone above the surface of the road or path. With an annular space at the top and drainage at the bottom, there is a thoroughfare which will prevent or minimise sweating. Far better is it to leave off the bases altogether, even to be so literally iconoclastic as to break off existing bases and sell them in aid of the depreciation fund, for which our children will look with lamentations.

This question of ventilation applies with almost greater force to the poles. The necessity for ventilating such closed spaces is acknowledged by every one who designs a feeder pillar. Pieces of armoured cable have been removed from watertight pipes leading from pole to feeder box. No water could enter *vid* the box, nor at the joint between pole and pipe, nor could it pass from outside by the cables at the top, as these are too well bushed, but the cables may conduct to the pipe the moisture which is deposited on them by sweating; and the fact frequently observed when pulling out the cables, that they are covered with slime from top to bottom, makes this source of moisture indisputable. The cable-pipes end in an easy bend, taken into the pole with the end upwards. Notwithstanding all these precautions the pipe filled with water in the course of three or four years, and the cables finally broke down through the armouring to earth. The same thing has occurred within our knowledge many times, and during the investigation of the failures from one to several feet of water were found in the poles, and in view of the way in which the poles were set, it is improbable that this water found its way in from the bottom.

The question of sweating seems to require further investigation, for it is important even when the feeder cables are made of such materials and are treated in such a manner that damp will not affect them, as the poles are reduced gradually by oxidation. Suitable ventilation top and bottom ought to do much to overcome this trouble, and it would help matters to coat the interior of the pole with Angus Smith's compound after manufacture.

Experience gathered from various quarters seems to show that "side feeders" or "section cables" should be taken out of the pillar somewhere near the top, passing to the pole in a pipe at that level. Heavily taped and braided I.R. or V.B. cables are better than lead-covered paper cables, and armouring is unnecessary and objectionable.

Collars.—Another luxury, for which there is no more excuse than the base, and to which the objections are even stronger, is the cast-iron collar which conceals the joints in sectional poles. There are two per pole, costing from 2s. to 3s. 6d. each, averaging, perhaps, 2s. 6d. These trinkets run to £30 or so per average route-mile, and are worth saving on that account alone. They are nearly as elegant as warts on a tree trunk, and merely substitute their own ugliness for the ill looks, supposed or actual, of the returns made by the junction of the sections. Like the bases, these collars are rarely, if ever, lifted to paint the hidden parts of the pole, and few people know that they catch and hold rain. If they are examined, many are found to be broken. This follows on the entrapped water freezing. As many as 82 per cent. of the collars on one stretch of line were found in this state. Lift them, and a mass of rust is disclosed. The rust holds water like a sponge, and the pole, especially at the joint, is attacked continuously in this insidious manner.

If collars are to remain, it is important that they be drained, and that the parts of the pole beneath shall be painted as regularly as the remainder.

Span Wires.—For the very reason that poles are too heavy, span wires tend in that direction also. High tensile strength and good galvanising are greater considerations than any other, and 7/15 or 7/14 make strong enough spans for all but very heavy work.

Guard wires should be fied in at every span to localise breakage, not tied merely to keep them in position relative to the trolley wires. If clamps are favoured against the simpler, cheaper and as effective binding-in, they should be made of malleable iron.

Hangers.—The use of bronze or gun-metal fittings throughout the overhead equipment has become second nature in some engineers. Other things being equal, gun-metal is the nicest material for the work. It is not liable to rust, and its constituents can be mixed in any proportion to suit the engineer, while it is considered an eminently safe metal when well made; but other things are not equal.

Malleable iron, when made as it should be, and as it can be made, is nearly as strong as gun-metal, and is quite as safe in the sizes ordinarily used. Malleable iron goods must be well galvanised before use, and ought to be painted once every two years or so after the first three to five years, except in special circumstances. Current net quotations compare as follows:—

	Bronze.	Malleable iron.
Straight line insulator castings ...	2s. 3d.	0s. 10½d.
Single pull-off " " ...	2s. 7½d.	1s. 0d.
Double " " " ...	3s. 1d.	1s. 1½d.

A large number of tramway engineers declare that it is impossible to use malleable iron fittings in this country, while, on the other hand, a large proportion of others use malleable iron with satisfactory results. Economy without the sacrifice of safety can be obtained by the use of malleable iron fittings, and the saving per route-mile will be something like £8 if we assume 100 insulators per mile.

Malleable iron hangers have the advantage over those made of bronze that no local action occurs between the span wire and the hanger. This action has not received notice hitherto, but it is marked, and is the cause of serious weakening of the span wire.

An excellent instance of this action has come under the direct observation of the authors. On the whole of one route 5¼ miles long, the hangers are of bronze; on another route, 4 miles in length, and a branch of the first, they are of galvanised malleable iron. While the span-wires where they clasp the bronze hangers are practically eaten through and have broken in several cases, the galvanising of the span-wires under the malleable iron hangers and on the hangers themselves is as good as it was when put up. That is conclusive evidence against the decay of the first span-wires being caused by rust. The same action occurs wherever the span-wire is attached to secondary insulators in which the eyes are of brass.

Insulators divide themselves into two classes, primary and secondary. Of primary insulators, that most commonly used consists of an insulated bolt contained in a metallic waterproof casing, of which the composition has been discussed above. The insulated bolt is exposed from beneath to driven rain, to rain splashed from the trolley wire ear, and to water thrown during rain from passing trolley wheels, the last being the most serious, and, until recently, the most unexpected. Water thrown from trolley wheels contains conducting matter like copper dust from the trolley wire, brass dust from the trolley wheel, and graphite or oil from the trolley wheel bush or bearing; and it is to that extent at least undesirable, as it must deposit in time over the insulated surface of the bolt a conductive layer. But, apart from the deleterious action of the suspended matter, the water itself is injurious to the insulation, as we shall attempt to show.

The firsts bolts were, and those most commonly used now are, of steel; comparatively lately the steel has been galvanised, and an alternative in the shape of a gun-metal bolt has been introduced. In all cases the average radial thickness of insulation is $\frac{3}{16}$ in., while the length of leakage path runs from 1 in. to 1½ in. The reduction of this leakage path begins from the day of erection, and, sooner or later, depending in some unknown degree on local circumstances, every bolt must fail. The trouble with them on the older lines has been acute, and recourse is had to all manner of shifts to overcome it.

First of all, moisture attacks the exposed end of the bolt, and a semi-conducting film is deposited over the whole insulating surface.

any more than that, they would find the light poles which they

That may take a year, or two years, or in exceptional circumstances it may take no longer than six months. But the really dangerous action starts when the rust eats under the insulation from the exposed end. Gradually and gradually that process goes on until the cylinder of compressed insulation begins to swell and to crack under the pressure of the increased volume beneath it, and at length there is no effective insulation at all except the $\frac{3}{16}$ in. radial thickness between the bolt and the hanger casing. A little more and that is bridged, with perhaps disastrous result.

To galvanise the bolt but lengthens the period over which this cycle of fate takes place; it does not stop it. Obviously the cure should be to use brass bolts, which do not oxidise appreciably. Why, then, is the fact well authenticated that brass bolts fail even more frequently than iron bolts?

Electrolysis is the main factor concerned in the destruction of both iron and brass bolts, although at first sight plain oxidation seems to be enough to account for the failure of the iron bolts, as explained above, and we will leave them for the time in order to consider the history of the brass bolt. Imagine slight leakage occurring over the insulated surface. In the presence of an electrolyte supplied by the trolley wheels, if by nothing else, particles of brass are carried down the stream and become deposited by degrees over the whole surface, leading finally to failure of the insulation. In the case of the iron bolts the same thing happens, but the deposit of pure iron is oxidised almost immediately and does not afford a good path.

That very fact accounts for the remarkable spreading of the oxidising process. If the finely divided iron did not oxidise, the quarry from which the supply was taken would be deepened, while remaining fairly local, until a sufficient film to cause a breakdown was deposited over the insulation, as in the case of the brass bolt. But after every attack the eroded surface oxidises as well as the

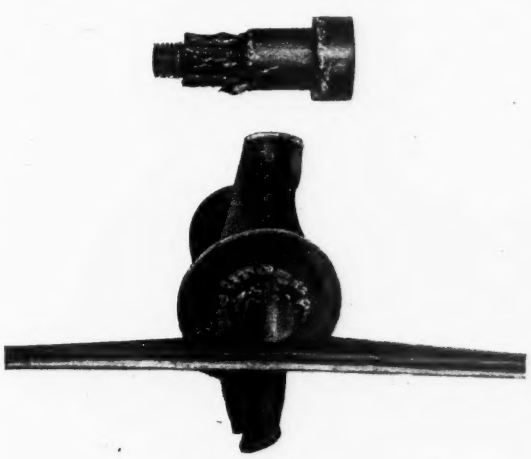


Fig. 1.

deposited film, and raises the resistance of the affected surfaces, so that the next attack has to be made from another and easier quarter. These operations recur continually, and their field constantly widens until the metal under the bolt is reached and succumbs in due course. Directly that happens the insulating cover begins to rise off the bolt, and time only—of which there is plenty in five years—is needed to fissure the cylinder and effectually reduce the leakage path.

An interesting specimen of a complete hanger with ear attached (fig. 1), which was removed from the line before failure occurred, shows to what a degree this action may go without serious consequences. Undoubtedly during wet weather the leakage across this hanger was considerable.

A length of 5 miles was equipped with brass bolts; another of 4 miles, in a much less pure atmosphere, but within the same 10-mile circle, had iron bolts. Neither were backed by secondary insulation, except such as might be afforded by sleeves of fibre. During heavy and continuous rain it was always the former line from which came reports of "live poles," although many of the iron bolts had the appearance of being useless as insulators from the way in which the coating was split. It was a noticeable fact that brass bolts lasted for a shorter time, and failed even more suddenly than iron bolts because they gave so little visible notice of their intention.

There are three ways in which these troublesome and expensive failures may be prevented or alleviated. First of all, we believe that entire prevention can be obtained by the insertion of a shield* between the trolley-wire ear and the hanger, in order to keep the bolt dry. The trolley-wheels cannot then throw water into the interior of the hanger. Secondly, the form of the hanger may be altered, making it nothing more than a metallic link between the ear and the span-wire, and providing for insulation by means of two (three per span) external and independent insulators. Lastly, the hanger may be composed of homogeneous insulation, such as glazed porcelain, something in the shape of a cable sealing-end, through the centre of which a plain metal bolt is passed. Whatever form the primary insulator takes it must be kept dry, or leakage and carriage of metal will start. Therefore, this porcelain insulator should be provided with a hood of some light material to guard it against rain, and with the shield mentioned above to prevent access of moisture from the trolley-wheels.

Secondary Insulators.—Those in most general use are of three kinds, known respectively as "Brooklyn strains," turnbuckles, and

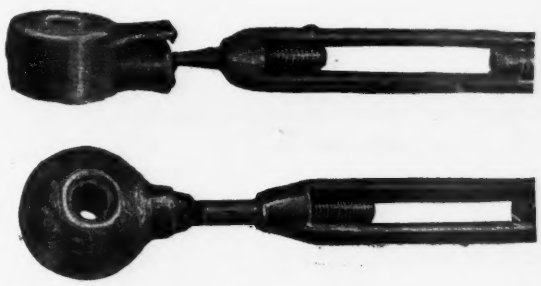


Fig. 2.

"globe strains," with a fourth, the porcelain reel, coming into favour.

The first two are adjustable. Actually they were never wanted in England; they are other things for which we have to thank America. No English lineman wants such devices during the erection of a line, and after this is once done there is still less necessity for them. Nevertheless, both types have been used by thousands.

Of the other type, that is to be preferred which is the most homogeneous, and has least parts of any kind, and of metal in particular, while giving at least equal results in other ways. On every account the porcelain reel is the one to use.

Born under adverse conditions, this insulator has withstood the unclean atmosphere of the Black Country and of the Potteries with remarkable success.

While in malleable iron the smallest "globe strain" can be bought in large quantities at 8d. to 8½d., the small reel runs to about 1½d., and the large to, perhaps, 3d. Few engineers have considered either the smallest "globe strain" or malleable iron safe to use; they have indulged in the larger sizes in bronze, at from 1s. 10d. to 2s. 2d., or even 3s. The use of the larger reel, then, will reduce the usual cost per mile by from £8 to £16, and another small saving can be made on flexible suspensions by inserting the reels into special jaws cast on the brackets.

In order to simplify matters still further, and at the same time to increase the efficacy of the secondary insulation, a reel with more than one corrugation may be used, preferably one with three, and identical with that proposed above for the hanger. Under such conditions the whole insulation of a span would cost no more than 2s. 6d. to 3s.

Leakage and Electrolysis across Secondary Insulators.—That end of a "Brooklyn" or a "turnbuckle" or a "globe" which was attached to the pole—the negative side of that part of the circuit—can be identified by the collection of copper sulphate which has formed close up to the insulation. In the same way the zinc first and the steel next of the span-wire where it encircles the reel insulators falls a prey to the action, and gradually changes into a mass of oxide.

Insulated turnbuckles (fig. 2) are more liable than any other insulator to rapid deterioration. When used in the orthodox style, electrolytic action removes iron or brass from under the open end of the insulating material and splits it up as in the hanger, while turned the other way, with the insulator next the span-wire, the metallic ring or thimble is eroded and deposited over the negative surface of the insulating material and over the metal, but without any splitting taking place. For that reason it is better to use iron rather than brass, or the same troubles will arise as with brass hanger bolts.

Manchester uses triple insulation, but fate is pursuing her all the same. The end will be postponed, but it will come at last, as it will come to all, unless the source of the trouble is stopped by keeping the primary insulation dry.

If the other types of secondary insulators are examined the characteristics of electrolysis will be found invariably.

No one who has such facts in his possession can hope that the insulators on the tramways of England, taken as a whole, can last 15 years, unless steps are taken to prevent the dangerous leakage that goes on now.

Trolley-Wire and Trolley-Wire Ears.—Until quite recently the general practice has been to use circular trolley-wire fastened to the supports by sweated ears. Circular wire suspended in this way is unsatisfactory, but the fault lies with the ears and not with the wire.

The only problem involved is to provide an absolutely smooth and unbroken path for the trolley-wheel. If there is any change of section or gap in that path the wheel must jump, with the result that when no current is passing to the car the effect is identical with the effect of car-wheels at the joints of rails, and that when current is passing a more or less destructive arc is formed.

This trouble is the direct cause of the substitution of flexible suspensions for rigid suspensions on bracket-arms, for double insulation could be managed without the "bowstring." So long as the trolley-wheel runs with perfect smoothness, flexible suspensions

* British Patent No. 13,062/05.

have no particular advantage over rigid suspensions, if the trolley-wire is as taut as it ought to be. In fact, we suggest that economies may be made in this direction now that figure-8 and grooved wire have come into fashion.

There is no doubt of the efficacy of 8-wire in supplying the desideratum mentioned above, but the grooved section hardly does this, as the ears cannot be made to clear the trolley-wheels.* Nevertheless, the use of 8-wire is not extending in any marked degree. Two well-known firms of wire-drawers replied to an inquiry as to the ratio of 8 and grooved wire to circular supplied by them in the following terms:—

1. "We cannot say exactly, but the proportion of figure 8 is very small, and we have been informed that this is being practically discarded in America, where it was very much used a few years ago."

2. "The present ratio of demand for grooved is about 10 per cent. of the round, while figure 8 has practically ceased to be used according to our experience."

These makers state that the extra cost of grooved and 8-wire (weight for weight) is from £2 7s. to £3 per ton, but a large user of 8-wire writes that "there is no difference in the cost of wire, makers quoting us the same price per pound for each type." In any event, the difference in price is almost negligible, and might become so altogether if either section were used to the same extent that circular wire is now.

Then with regard to erection, a correspondent who has designed a complete line of fittings for both grooved and 8 wires, and has supplied large quantities of both, but has not carried out the erection, says: "The first cost of the fitting for the grooved wire is slightly more than the round, but not so much as in figure 8. It is very easily adjusted when up, and the wear on the fittings is practically nil. The wear of the wire is less than in the sweating system, as there is practically no under-running, and there is not the objection of having heated wire as in the sweating. . . . The objection to figure-8 wire is that it is more difficult to erect than the grooved wire, and more expensive in fittings, and in requiring more experienced men to fix it, but when properly fixed it makes a very satisfactory job."

On the other hand, the user quoted above on price says that "there is no greater difficulty in erecting figure 8 than circular wire of similar sectional area, contractor's price for two recent contracts being the same per 100 yards for both. . . One section . . we have had working has given us no difficulty or trouble of any description," and he adds: ". . . in my opinion figure 8 is much better than grooved, one of the chief reasons being that the top lobe of the figure 8 allows a much better grip for ears than grooved wire, also *the bottom lobe, if you use, say 2/0 section, can be made so that the contact area to the trolley wheel is equivalent to* 4/0 *circular*." The words in italics are pregnant with wisdom, as we shall see later.

The fact has to be faced that circular wire with the present forms of ear means continual expenditure for repairs and an unpleasant feeling that too much depends on the linemen. Under these conditions—conditions which exist on 2,000 miles of tramway in this country—there are nearly 100 potentially weak points in every mile.

It is possible that an ear will be found which will give a new lease of life to existing circular wire. We submit an ear for criticism which we have some reason to believe fulfils the requirements. The great objection which we foresee will be raised against it is that it is a return to soldering just when everyone is trying to make mechanical ears for circular wire successful. In this ear the soldered area is less than has been proposed before; but the area is quite enough, and the part soldered to the wire is made of copper tapered off to flexible ends, in order to overcome the tendency of ordinary shallow-grooved ears to part from the wire at each end because of their inability to follow the small but frequent movements of the trolley wire at the points of suspension. These ears put circular wire on the same plane as 8-wire.

The tendency in 1904 was towards heavier sections than the 1/0 which was almost a standard for several years, and during the interval that tendency has become more strongly marked. Mr. Sayers says that "there is no electrical necessity for using any wire larger than 0 S.W.G. . . . unless the traffic is extremely heavy," and in certain other special cases, as on curves of short radius. Our opinion is that an equivalent section to 2/0 circular wire is the maximum required by the average tramway.

Those tramways using a 4/0 have sunk £80 and £56 per mile more than they need if they had used 1/0 or 2/0 respectively; and those which have used 3/0 have sunk £48 and £24 extra. On Mr. McElroy's figures for the year 1904, the total capital sunk for no appreciable gain amounts approximately to £39,000 and £25,800 respectively.

Those figures are startling when one reflects that they relate to trolley wire alone, and to no more than 47 out of about 300 tramways in the kingdom.

There is a real need for larger contact area between trolley wheel and wire than is possible with 1/0 or even 2/0 circular wire, and it may be that this need has helped engineers towards the use of 3/0 and 4/0 circular wire, but the same effect can be obtained in a cheaper way by rolling 1/0 or 2/0 wire to a flattened curve on the under side.

We are the more insistent on the subject of returning to smaller sizes because the figures of wear which we give show clearly that, points of suspension apart, No. 0 S.W.G. has a useful life which meets all present requirements.

Although circumstances have prevented the figures being complete, and although much remains to be done in this way by other and more competent observers, we think that the general statement above is fairly well borne out, and that there is some positive foundation for our conclusions:—

1. That the depreciation due to rolling friction is almost negligible.

2. That sliding friction may be reduced to the same negligible quantity by attention to alignment and by the universal use of swivel trolley heads of the freest type.

3. The arcing is the most serious trouble of all, and must be discounted by the use of modified trolley wire section and a complementary trolley wheel.

4. That the effect of an impure atmosphere requires further elucidation.

5. That the method of suspension does not affect the wear, and

6. That the effects of (*a*) height of wire and (*b*) pressure of trolley wheel require careful examination.

[A collection of tabulated data followed.]

* Electrical Review, August 11th, 1905, p. 211.

The Electrical Wiring of Small Buildings.

By R. Robson.

(*Abstract of Paper read before the* Institution of Electrical Engineers *at Newcastle, February 5th*, 1906.)

If lighting and heating are to be adopted by middle-class people of moderate means—that is, by persons living in houses from £20 to £40 rental—it must be possible to give them a good installation, but one which will cost very little more than gas-pipes do to put in, especially in new houses, where the builder pays for the installation. Houses of under £20 rental are generally free-wired on the slot-meter principle, to which system nearly all the supply authorities are devoting a considerable amount of attention. Gas-pipes in six and seven-roomed houses can be put in for less than 7s. 6d. per point, good electric wiring in close-joint tubing at the very lowest for, say, 9s. or 10s. per point and switch for wiring only.

Want of ventilation, accompanied by dampness, will affect any method of wiring except screwed tubing, and as for vermin in dwelling-houses they are not worth taking into consideration. During the writer's experience of 13 or 14 years he has never seen any wiring so damaged except a little paraffined bell wire in one case.

Although he has used many miles of close-joint tubing, and is still compelled to use it in large quantities, the writer's opinion of this material is a very poor one, but as it is the method adopted in ninety-nine cases out of every hundred for wiring this type of building, it is the system he will have to criticise considerably. The plasters used nowadays very often contain acid, and then it takes a very short time to eat away the tubing and leave no protection to the cables. Not only is condensation to be contended with, but the moisture in the brickwork and plaster drains through the *close joint* into the tubing, and so finds its way to the switches, and very often eats away the wire ends and causes the wood patrass to char or burn if the switches are mounted on wood blocks, as is usual in cheaper installations. This type of tubing is, to a certain extent, a mechanical protection, but it is by no means an uncommon occurrence to find nails driven right through the tubing and out again at the other side, and it does not take a large nail to do this—an inch oval brad is quite sufficient. The writer came across about 20 ft. or 30 ft. of such tubing damaged in no less than nine places by a joiner putting up picture beading, cutting right through the tubing and four or five wires, not even knowing he had gone through it. Builders and architects insist on having steel tubing, but will not pay for steel barrel, and think because they are getting a steel tube they are all right. In fact, in old buildings, where casing is second to nothing, they think you are trying to impose upon them if you suggest casing in preference to "close-joint steel tubing."

Though no good firm will put joints in a tube, they are often found, and cause no end of trouble. Frequently too many wires are drawn into a single tube, and the necessary drawing-in boxes not having been fixed, the wires cannot be drawn out owing to one wire being twisted round and round another.

The deterioration of the cable is a very common occurrence. Foreign rubbish is often put in, and soon perishes with the presence of a little moisture. A slight leak on the tubing often causes a fire if the tubing is not kept a reasonable distance from the gas-pipes and properly earthed. The use of a foreign instead of a C.M.A. cable will make 10 per cent. or more difference in the price of an installation, and more than one builder has informed the writer that "we are building houses to sell, and we want the lowest price; after we have sold the house we have washed our hands of it." Could anything do more to encourage bad workmanship than this?

If there were any supervision of installations during erection, as there should be, most of the faults would not occur. Fire offices have their rules, but never on any account dream of inspecting small houses until a fire occurs; then they probably send a clerk out of the offices, when it should be an expert. If the insurance people could afford a little more time and attention to go into the matter, they would easily see that a good cable run on split insulators makes a thoroughly sound job. What possible objection can there be to a good cable run on split insulators along the joists and through the joists in separate holes, and brought down in insulating tubing if inside the walls, or if outside, in a piece of casing? (In passing through the joists a ¾-in. hole is large enough for each wire, and this prevents the cutting and hacking of great pieces often over an inch deep, weakening the joists to an enormous extent.) Wires could even be jointed, using this method, and make a first-class job that would easily compete with gas-pipes. If this were done, more than half our trouble would disappear.

Lead-covered paper-insulated cables are not advisable; they are too liable to be affected at the ends by dampness, and are very slightly cheaper than rubber-covered for small sizes. They also want very careful handling. A good job can be made with good lead-covered cables clipped to the joists and carried down the walls in casing, or protected with a metal shield. With the latter method you have earthing to see to again, and the lead, if let into the plaster, is often affected by it. There are some very good jointing devices on the market for lead-covered cables, but these add considerably to the cost of small installations. On the whole, the writer considers close-joint tubing is responsible for a least fourfifths of the electrical fires that take place. Perhaps we should not blame the system so much as the bad workmanship, which is less apparent with this system than any other. Poor cable comes next in order as a cause of fires.

The writer has recently run some miles of flexible on insulators in several hundred cottages; some of them have been in use nearly a year, and appear to be quite satisfactory. This arrangement would not do for the middle-class houses, but it is a system which can be done about 20 per cent. cheaper than casing in completed premises.

If the split insulator system is satisfactory in works or large warehouses (and it is), and since it is as safe a method as screwed tubing for all ordinary work, why can it not be adopted for housework? It only wants sanction and approval by the leading supply and insurance authorities. It would become the most generally used system of any, and help a great deal to get the small householder, who is the best-paying consumer, as he is the most numerous. Twin lead-covered cable makes a very nice and cheap job for heating circuits in a house, as wall switches seldom are required. The switch is usually beside the plug, and if more than one plug is on a circuit it can be looped from the last one. This style can be done nearly as cheaply as split insulator work, and causes very little disturbance of the premises if put in after erection.

Wiring must only be cheapened by adopting a system that is simple and can be erected quickly and last a long time without repair. This can only be got by using skilled workmen, however simple the installation, and using nothing but the best British-made material, and paying particular attention to the cable.

Physical Society.

At the meeting held February 23rd, 1906, Prof. J. Perry, F.R.S., President, in the Chair, a paper by Mr. J. Walker, entitled "A Note on Talbot's Lines," was read by the Secretary.

A paper on "Secondary Röntgen Radiation" was read by Dr. C. G. Barkla.

A paper by Messrs C. W. S. Crawley and F. B. O. Hawes entitled "Records of the difference of potential between railway rails when a train passes and at other times, and a suggested method for the observation of earth currents and magnetic variations," was read by Mr. Crawley. The experiments described in the paper were made on the London & South-Western main line, between Walton and Weybridge stations. To each rail of the up line a wire was permanently attached, and the other ends of the wires were connected to the terminals of a reflecting galvanometer. The deflections of the galvanometer were recorded on a moving sheet of paper, and curves obtained showing the variation in the current through the galvanometer. The curves showed a concordance in the results from successive trains. The normal current through the galvanometer began to be disturbed about one minute before the passage of a train, and the disturbance lasted about two minutes. It appears probable to the authors that the effects are due to earth currents, and they suggest that by making the galvanometer very sensitive its deflections might furnish a means of studying their variation.

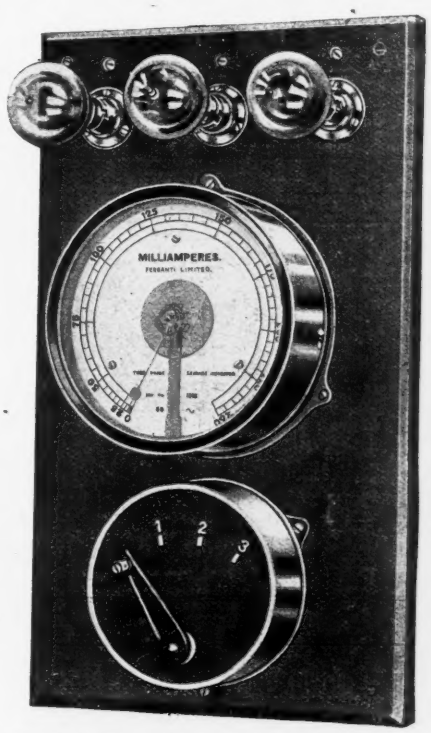
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Three-Phase Leakage Indicator.

In accordance with Rules Nos. 6 and 7 of the "Special Rules for the installation and use of Electricity," issued by the Home Office, an instrument is called for which will show immediately any defect in the insulation of the system. The readings of this instrument are to be recorded daily in a book kept at the generating or transforming station or switch house. In the accompanying illustration we show the three-phase leakage indicator for circuits in which the neutral points are not earthed, which has been put on the market recently by Messrs. Ferranti, Ltd., of Hollinwood, Lancs. The constituent parts of the apparatus are a long scale alternating current milliammeter reading up to 250 milliamperes, a spring four-way switch, a special resistance and three tell-tale lamps. The whole of the gear is attached to a polished slate base and is provided with fixing screws, thus making a self-contained piece of apparatus which can be fixed up on pieces of angle iron, or in any other way, in any convenient position.

We are informed that Messrs. Ferranti, Ltd., have been notified by the Home Office that this apparatus fulfils the requirements of the special rules referred to, and that already a considerable number of these indicators are in use.

The three lamps are connected in star; to the artificial neutral point so formed one terminal of the milliammeter is connected, and thence, through a switch, to earth. The voltage of the lamps must correspond with the voltage between phases. Thus, if there are 500 volts between phases, two 250-volt 16-c.p. lamps must be used in series on each phase. Under normal working conditions the tell-tale lamps would glow with equal dulness, providing the insulation on each line is good. A *slight* leakage on any line, though not sufficient to be seen by the eye on the lamps, will be indicated on the milliammeter; with perfect insulation, therefore, no reading will be observed on the instrument. Directly, however, the insulation begins to fail this will show up on the milliammeter. Should one of the mains become of bad insulation the lamp

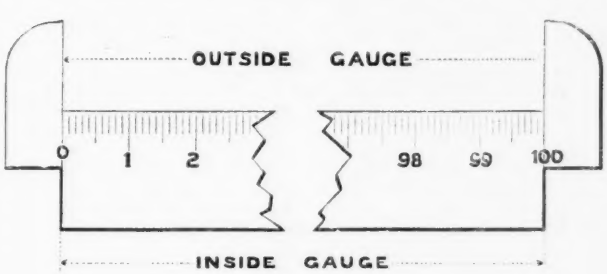


Ferranti Three-Phase Leakage Indicator.

belonging to it goes out, and the other two burn brighter. The object of having the lamps is to indicate directly a bad fault comes on the system without the attendant having to make observations on the instrument. In order to get a more accurate criterion of the insulation, readings must be taken periodically with the switch in positions 1, 2 and 3. By moving the switch off the normal position the earth on the artificial neutral point of the lamp is removed, and each line is connected up in its turn to earth, through a resistance as well as the milliammeter. This resistance is of such value that, with a dead earth on one phase, the instrument will indicate a full scale deflection when connected to either of the other two, and zero when connected with that one phase. Thus, for 500 volts between phases, the resistance is 2,000 ohms. The switch is provided with a spring which automatically brings it back to its normal position, thus preventing a careless attendant from leaving the switch in the wrong position.

Stanley's Patent Standards.

The introduction of "Invar" and special nickel steels, the coefficient of expansion of which is so small (viz., under ·000001 per degree F.) as to be a negligible quantity, excepting for laboratory use, has led Messrs. W. F. Stanley & Co., Ltd., of 4 and 5, Great Turnstile, Holborn, W.C., to put upon the market special standards

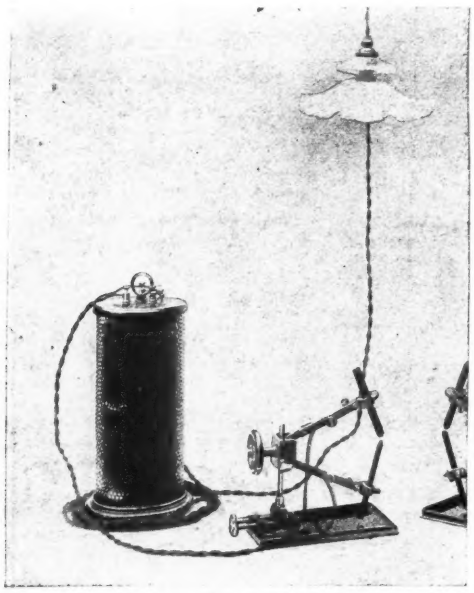


of high accuracy, which have recently been patented by them. These have the advantage of a three-fold use, viz., (1) an inside standard gauge, (2) an outside standard gauge, and (3) a standard scale gauge.

These three are usually made as separate standards. These standards are all certified by the National Physical Laboratory, and are reliable for the standardising and testing of measures in all city and borough offices. They are also most important for use in high-class engineering works. Messrs. Stanley have recently issued an illustrated pamphlet regarding the standards that they keep in stock.

Lantern Arc Lamps.

At the present day, when electricity is nearly always at hand, convenient methods of applying it to magic lantern use, in cases where a fairly powerful light is required, are much appreciated. In this connection Messrs. Wharam & Borland, of Leeds, have introduced a handy miniature arc lamp, specially designed for



Lantern Arc Lamp.

lantern or small cinematograph use. These are suitable for any pressure up to 250 volts, and take about 4 amperes of current; connection is made to the supply at a convenient lampholder, by means of an adapter plug and flexible cable.

Both vertical and horizontal adjustments are provided on the lamp, which is adapted for hand feeding, and supplied complete with resistance, as shown in our illustration.

A CONTRIBUTION TO THE THEORY OF THE SINGLE-PHASE INDUCTION MOTOR.

By VAL. A. FYNN.

(*Continued from page* 365.)

Motors of this kind can also be "compounded," but not in the same sense as a continuous-current motor; such a disposition is shown in fig. 6. There the field generated by F is really due to the magnetising component of the current sent through F by E^2. This current lags by 90° behind E^2, and is therefore co-phasal with E^1, and, if the power factor of the motor be unity, also with the current through S. That being so, the current flowing through S^1, which is the same as that flowing through S, must produce a field practically co-phasal with that produced by F. The shunt excitation is in this case, and by way of example, entirely supplied by the coil F (the D D circuit remaining open), whereas S^1 provides the "compounding"—*i.e.*, provides more or less of the motor field, the latter, however, tending to remain constant.

Another method of varying the strength of the motor field for the purpose of varying the speed of an alternate-current shunt motor is illustrated in fig. 7, and consists in including in the rotor circuit along the motor field axis an E.M.F. of practically the same phase as that generated in that axis by revolution in the transformer field. This E.M.F., designated by E^2, should be chosen in quadrature with E^1, and can be derived from any convenient source, including the motor itself. In this case it is supposed

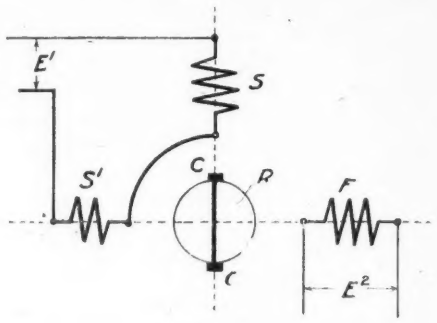


Fig. 6.

to be derived from a transformer T. If it is of the same direction as E R, then the speed of the motor will be reduced, because the field will be strengthened, and E R will become nearly equal to E T at a lower speed than would be the case with the weaker field generated by E R only. The greater E^2 the slower will the motor run, provided, of course, the E.M.F. impressed on the stator remains constant, and thus keeps E T constant or nearly so. If E^2 is connected up in opposition to E R, the motor field will of course be weakened, since the resultant E.M.F. in the D D circuit will decrease, and in

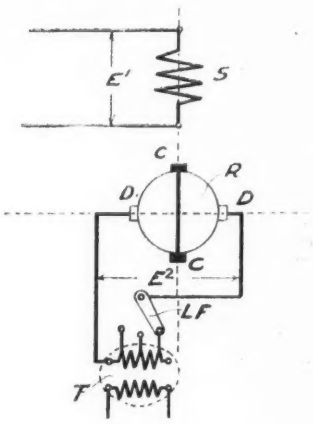


Fig. 7.

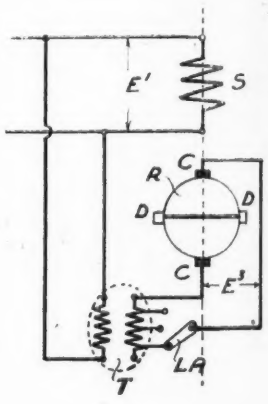


Fig. 8.

consequence the speed will rise in order that E B may nearly equal E T notwithstanding the weaker motor field.

In fig. 8 is shown by way of example one method of varying either the working E.M.F. designated by E T, or E B the back E.M.F., without varying the transformer or the motor field. An auxiliary E.M.F. designated by E^3 is for this purpose included in the armature axis (C C) of the rotor. This auxiliary E.M.F. should be of the same phase as that induced along that axis by transformer action, and therefore co-phasal with E^1. It is shown as derived from a transformer T, which can be connected in parallel with the supply, or it can be obtained from any other convenient source, including the motor itself. The E.M.F. impressed on the stator is supposed to be kept constant; and in this case at nearly synchronous speed, the motor field will practically equal the transformer field, and E B will practically equal the E.M.F. induced by the transformer field in the armature axis of the rotor. If E^3 is now introduced into the armature circuit, and its direction is so chosen that the resultant E T becomes greater than it was before the introduction of E^3, then the speed must evidently increase in order to allow E B nearly to equal the greater E T. In a motor where the motor field is solely due to rotation, the increase in speed thus brought about will not be proportional to the increase of E T, because the motor field itself will increase with the speed. When a wide speed regulation is required it is, therefore, advisable to provide means by which

the motor field can be kept constant, or even reduced, notwithstanding a rise in speed. Such means have already been indicated; one example was shown in fig. 5 and another in fig. 7. It is clear that saturation must soon be reached if the field is allowed to increase with the speed.

Should E^3 be chosen so as to oppose that E.M.F. which is induced along C C by transformer action, it can be looked upon as either decreasing the resultant E T, or increasing E B. Whichever view is taken, the result is the same, *i.e.*, the speed will be lowered.

The author has found that the inclusion of self-induction in the armature axis of the rotor is detrimental to the operation of the machine. This contention is fully borne

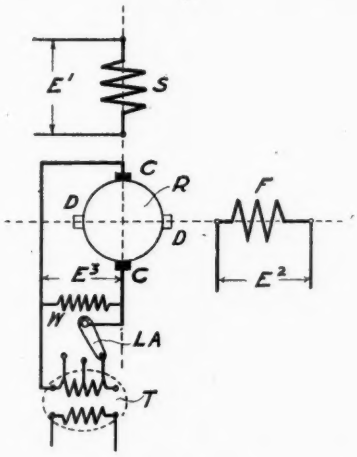


Fig. 9.

out by the author's theory as laid down in this contribution. In order to avoid this inconvenience when regulating the motor as has just been described, it is advisable to make use of the arrangement shown in fig. 9. The auxiliary E.M.F. is there derived from a non-inductive resistance W on which

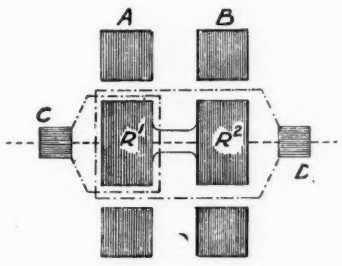


Fig. 10.

an E.M.F. of suitable phase is impressed, which, of course, can be derived as before—for instance, from the mains. Instead of a non-inductive resistance, a capacity can be used, and this latter will help to improve the power-factor of the motor.

Another method of influencing the magnitude of E B, the back E.M.F., without varying either the transformer or the motor field, is shown by way of example in fig. 10. Two stators A and B are placed side by side, enclosing the double rotor R^1 R^2. One of the stators, say, A, carries the winding S. The rotors carry two windings. The one (the armature winding) embracing one rotor only (R^1) is short-circuited at the commutator C co-axially with S; the other (the field winding) embraces both rotors, and is short-circuited at the commutator D at right angles to the axis of S. The motor field is generated in both rotors and stators, because the field winding embraces them both. At nearly synchronous speed, the total number of lines will be equal in the transformer and in the motor field. The winding responsible for the back E.M.F. in the C circuit, however, only embraces one rotor, and consequently only a part of the motor field, so that the smaller that part is, the greater will have to be the motor speed in order to produce the required back E.M.F. with the help of that reduced field. The speed can be varied, for instance, by varying in some well-known way the magnetic reluctance of the path for the motor field afforded by the stator B, thus forcing more or less lines to link with the armature winding responsible for the back E.M.F.

As a last example we will describe one type of motor in which the working E.M.F. is impressed on the armature by conduction, whereas the motor field is generated in the

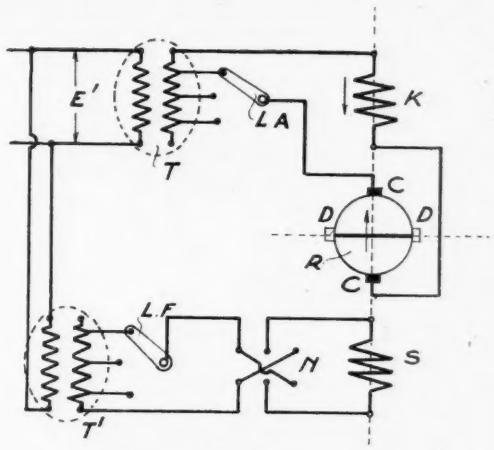


Fig. 11.

motor itself by rotation in a field corresponding to the transformer field in motors in which the working E.M.F. is conveyed to the armature by induction. The motor selected for this example is shown diagrammatically in fig. 11; the E.M.F. (E T) impressed on the armature can be varied, for instance, by means of the regulating lever L A. The field produced by the armature ampere-turns is equalled and opposed by a field due to a co-axial winding K disposed on the stator; by this means the armature self-induction is neutralised. Another winding S disposed co-axially with K is connected in parallel with the supply, and produces a field in that axis which lags by 90° with respect to E^1. By rotation in this field, an E.M.F. co-phasal with that field is set up along D D, and produces a field in that axis which will lag behind the E.M.F. producing it by 90°, and which, therefore, will be co-phasal, or nearly so, with E^1. The armature circuit being devoid of self-induction, the current in that circuit will be practically co-phasal with

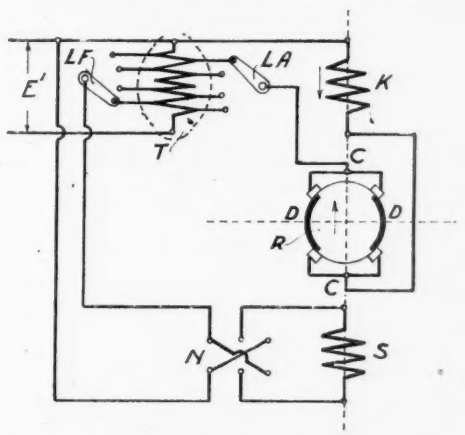


Fig. 12.

its E.M.F.—that is, with E^1, and a torque will be set up between armature current and motor field in the same manner as, for instance, in fig. 1. The back E.M.F. is again dependent on the motor field and indirectly on the field due to S, also of course on the speed. Now the field due to S can be regulated in a number of ways; for instance, by means of the lever L F. The direction of rotation can be reversed by reversing the current through the armature or reversing the motor field; the latter can be achieved by reversing the current through S by means of the switch N. The field produced by S can be weakened or strengthened

with increasing load by making the armature ampere-turns greater or smaller than the ampere-turns in the winding K. With this arrangement any desired speed can be obtained.

Quite a number of variations of this arrangement are possible. In fig. 12, one transformer only is used for both armature and field circuit, and in addition the arrangement of the brushes on the commutator is somewhat different. It is the converse of that rightly known as the Latour disposition, and which was also arrived at by the author, but independently of Mr. Latour. As a rule, it is the armature axis which is short-circuited by brushes disposed on that plan ; here it is the field axis. In the figure, that portion of the rotor winding which does duty as armature-winding is distinguished by heavier lines. In another modification part of the winding K could be made use of as S winding. Two separate rotor windings could be used instead of one only.

Although this motor can be regulated perfectly as far as speed is concerned, it will not start when connected up as shown in figs. 11 and 12. There are, however, a number of ways of starting such a motor. In fig. 13 a starting wind-

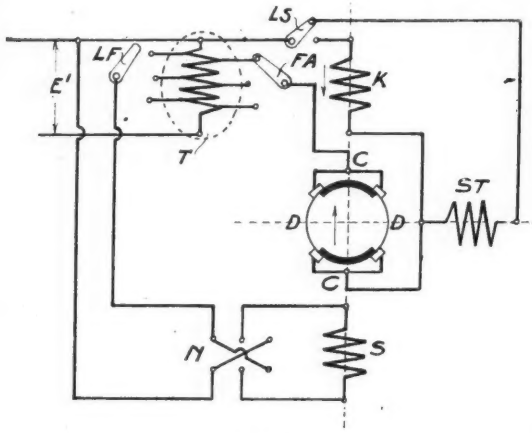


Fig. 13.

ing S T is provided, disposed in the axis D D, and at starting connected in series with that part of the armature which is not short-circuited, whilst the winding K is left out of circuit and the winding S is also disconnected. The motor will start as a series induction motor, the short-circuited portion of the rotor acting as the armature winding (heavy lines in fig. 13), and the remaining portion doing duty as field winding. The current is conveyed to the former by induction from S T in the axis D D, whereas the current exciting the motor field is conveyed to the rotor by conduction and in the axis C C. This mode of starting the motor has been selected purposely in order to demonstrate the extreme pliability of these alternate current motors. After the motor has started, the original connections can be re-established, care being taken, of course, to connect up the winding S so as to secure a continuance of rotation in the same direction. The S winding can also be used at starting. In the early stages, and as long as the back E.M.F. along the axis D D has not attained comparatively appreciable values, the motor will behave as a short-circuited transformer ; the current through S T, and consequently through the rotor in the axis C C will be very nearly in quadrature with E^1, and since any field due to S must be in quadrature with E^1 the field due to S will be nearly of the same phase as that produced by the current flowing through the rotor in the axis C C, the winding S will consequently assist the starting.

Some years ago the author devised means for improving the power factor of machines, such as are shown in fig. 1 ; a paper on the subject is now before the Institution of Electrical Engineers, so that these means need not for the moment be more particularly referred to here. They are easily applicable to the new motors here described and materially improve their operation.

There can be no doubt but that the term "single-phase induction motor" is a misleading one, inasmuch as it implies identity between such motors and those known as polyphase induction motors. The two are, however, very different, and the sooner this fact is universally recognised the better.

(*To be concluded.*)

THE NAVAL ENGINEER AND ELECTRICITY.

By C. ALFRED SMITH, B.Sc., A.M.I.E.E. (Late R.N.).

In the Electrical Review of February 2nd there were three separate and distinct articles with titles apparently entirely different, but upon subjects somewhat closely connected. There was a short editorial article entitled "Engineering in the U.S. Navy," an article called "The Up-to-Date Engineer," and one upon "Electrical Power in the American Navy."

The leader reminded us that the chief of the Bureau of Steam Engineering is somewhat alarmed at the present position of affairs in the U.S.A. Navy, and those of us who have followed closely the official inquiry into the unfortunate "Bennington" disaster will certainly be of opinion that there is good cause for alarm ; for in that awful disaster, in which many men lost their lives, and the rest of the crew were wounded, the sole reason for the boiler explosion was because of the negligence of a young ensign, a youth who would correspond to the young English sub-lieutenant straight out of Keyham. Such an accident—or, rather, perhaps, it would be more correct to say such negligence—has never yet been known in the British Navy. It is, however, rather surprising that inexperience has not been the cause of accidents, when one remembers the great responsibility which not so very many years ago was thrown on the shoulders of young Twenty-one immediately he graduated from the Naval Engineering College.

The situation was saved on more than one occasion because of the practical knowledge of engineering work which the youthful officer in charge had obtained in the dockyard ; but in common justice to an efficient branch of the service it should be said that the engine room artificers have always rendered splendid assistance (as well as respect) to the officer of the watch. Therefore, one may be excused for a passing protest against the recent Admiralty order, by means of which stokers will apparently do the work for which these engine room artificers are trained for.

The United States Government attacked the problem of naval engineering some years before our own Admiralty made their recent alterations ; and it may be that we shall benefit by their experience. But the problem is by no means settled.

It is quite obvious that the man in charge of these floating masses of mechanism, which we call warships, must be indeed an up-to-date engineer. Therefore, the prescription for obtaining this useful product of education given by Mr. Deepholts is of interest, although there are a few points in connection with the training followed in this Far Eastern college of which he writes, which are open to criticism. The chief one is that the time of training is all too short, for three years is certainly not sufficient to do both the theoretical and practical sides of engineering training. The "Sandwich" system, approved of by the London University, whereby six months' workshop and six months' college work is done by the would-be graduate in engineering, is splendid in its way, but there is not enough of it. If only parents could be made to understand, it is quite as difficult, if not more so, to train a professional engineer than a doctor. But it is the fault of the present day ; parents wish to rush their sons through their engineering training all too quickly. It is the rather unwholesome desire to get quick returns for a small expenditure of time and money, which is all too rampant in our profession. Four years is not a sufficiently long periods for college and works. And if in a four years' course there is not time to finish an engineer's training, then three years is not good enough. So much for the few remarks on the most interesting article on the "up-to-date" engineer, who would be more up to date if his training were twice as long.

Lastly, the article on electrical power in the American Navy. It does not seem to have much connection with the up-to-date engineer, but it can be used to sound a warning in connection with Admiralty methods. It is not so very long ago that my Lords awoke to the fact that it required an expert electrical engineer to advise them upon electrical matters. When Mr. Wordingham's appointment was announced, we all felt that changes rapid and sudden would follow. But beyond somewhat spasmodic attempts to bring the Royal Dockyards up to date—it is only five years ago that there was not a single motor-driven machine tool, crane or shaft in the whole of the Devonport Dockyard—very little has been done, and the system of the Admiralty with regard to electricity on board of ship is wrong. Electricity has been called upon, justly and unjustly, to answer for many things, and many ingenious crimes invented by our friends of the gas industry, but there has been more friction on board of ship among the executive and the engineers because of the use of electricity than for any other reason. The engineer lieutenant is responsible for the whole of the contents of the engine-room except any wires which are led from the dynamo terminals. Imagine such a state of affairs! In his own engine-room there are circuits of which the engineer is too ignorant to touch, yet for which he must supply the necessary power!

Now the use of electrical power in warships is being extended as it is on land; electricity is no longer used only for lighting purposes, and it is only right and proper that the engineer officer should be entirely responsible for the whole of the electrical apparatus. The torpedo lieutenant, good sort as he is, is usually somewhat of an amateur in electrical matters, and even though he may know the theory of his subject, he has had no real engineering training.

Those of us who pursue our avocations ashore are not always aware, or do not always remember, what an extremely complicated box of machinery the modern man-o'-war is. Think of a central station, with 70 separate and distinct auxiliary steam-driven engines, many of which are compound and all of which are used for such various purposes as driving feed pumps, steering engines, refrigerating machines, electrical generators and other "auxiliaries." The central station man would at once say that several of these engines should be motor-driven; and, perhaps, if the old school of engineers had more training in these matters economies would be effected in this way.

A few weeks ago I paid a visit to the new College at Osborne, but space does not allow me to discuss what I saw there too fully. There is much to praise, and there is one thing to blame; and that is, that sufficient importance is not given to electrical engineering matters. It is fairly safe to say that in a few years oil engines will be used for driving various dynamos on board of ship, but at present nothing is done to instruct the young cadets in this branch of engineering. The internal combustion engine and the dynamo provide the sole motive power of the submarine; yet how few are the engineers or executive officers who know very much about either? The Admiralty, in order to produce the "up-to-date" engineer, should provide fuller instruction in electrical matters, both for the cadets at College (Osborne, Dartmouth and Keyham) and also for the Naval officers who have graduated. The use of electricity would then probably be extended in the dockyards and on board of ship.

THE NEUTRAL MARKETS OF THE WORLD: THEIR OPPORTUNITIES.

I.—Argentine Republic.

Introduction.—In this series it is proposed to give an outline of the opportunities which present themselves in what are known as the "neutral markets of the world," *i.e.*, in such markets as have not yet taken up manufacturing industries to any great extent, and hence offer the greatest openings for trade for countries which are essentially manufacturing countries. It is intended, generally, to deal with the industrial and commercial conditions of the several markets with particular reference to the opportunities they afford for electrical enterprise.

The Argentine Republic has been selected as the first of this series mainly because of the extraordinary developments which this country is at present undergoing in every phase of its industry and commerce.

The population of Argentina does not exceed 5,500,000; nevertheless, the imports in 1905 amounted to £41,000,000, and the exports to £65,000,000, making a total trade of £106,000,000, or an average per inhabitant of over £20. The only countries which have a greater average total trade per inhabitant are Holland, Switzerland, Belgium, and the United Kingdom. This fact in itself should be sufficient to attract the attention of manufacturers of all classes to this market. Moreover, comparing the total figures for 1905 with those for the previous year, we find that the imports increased by about £3,600,000 and the exports by about £12,000,000, whilst the figures for 1904 showed an increase of nearly £12,000,000 over the average of the previous five years in the imports, and an increase of about £14,000,000 in the exports. The detailed figures for 1905 are not yet available, but the figures for 1904 show a marked increase in the importation of electrical goods. Taking a few of the headings given in the trade returns for Argentina, we find that the imports of telephone apparatus in 1904 amounted in value to 25,107 pesos (peso = 4s.), or an increase of 8,792 pesos on the quinquennial average; almost half the imports are from Belgium. The value of dynamos imported was 60,946 pesos, an increase of 6,453 pesos; 25,465 pesos were from the United Kingdom and 21,561 pesos from Germany. The imports of material for electrical appliances amounted to 304,095 pesos, or an increase of 108,823 pesos; the imports from Germany amounted to 117,115 pesos, an increase of 51,156 pesos; from the United Kingdom 98,040 pesos, an increase of 40,733 pesos; and from the United States 28,686 pesos, a decrease of 17,320 pesos. Motors, other than wind motors, were imported to the value of 571,433 pesos, an increase of 244,286 pesos; from the United Kingdom 123,854 pesos, an increase of 59,926 pesos; from the United States 228,689 pesos, an increase of 131,095 pesos; and from Germany 109,673 pesos, an increase of 51,468 pesos. Wire and cables for electrical purposes were imported to the value of 662,213 pesos, an increase of 144,654 pesos; the imports from Germany exceed those from all other countries together, and amount to 453,046 pesos, an increase of 217,024 pesos; the imports from Italy are next, amounting to 92,894 pesos, an increase of 92,894 pesos; the imports from all other countries show a decrease as compared with the average of the previous five years; in the case of the United Kingdom this decrease amounts to no less than 74,087 pesos. Electric meters were imported to the value of 40,776 pesos, of which 25,200 pesos were from Germany. Electric bells are practically all of German origin, whilst two-thirds of the electric ventilators imported come from Italy. Carbons for arc lamps were imported to the value of 27,054 pesos, of which 14,417 pesos were from Germany; and there were practically none from the United Kingdom. Arc lamps were imported to the value of 34,786 pesos, and incandescent lamps to the value of 99,274 pesos; of the former 25,222 pesos were from Germany, and of the latter 56,376 pesos. Tramway material was imported to the value of 499,958 pesos; the imports from Germany amounted to 200,313 pesos; from United States 142,894 pesos, and from the United Kingdom 103,610 pesos. In telegraph material, the United Kingdom holds almost the whole of the trade.

So much for the statistics of the imports of electrical goods, which go to show that, as a general rule, the imports from Germany have increased greatly, whilst in most cases those from the United Kingdom have not increased in anything like the same ratio. In many cases the cause of this increased trade with Germany may be traced to the fact that German capitalists have taken a keen interest in South American undertakings, and particularly in those of Argentina, hence the supplies for these undertakings have been of German origin. The interest which German capitalists have taken in Argentine enterprises was recently commented on by the German Minister at Buenos Ayres, who stated that German capital in that country was in a very flourishing condition, and that its employment was being greatly increased, particularly in electrical enterprises. The change in the last few years in the conditions on the Argentine market as to the countries supplying electrical machinery is extremely interesting. Reporting in 1898 Mr. Worthington, the Commissioner appointed by the British Government to inquire into the conditions of trade with South America, stated, with reference to Argentina, that the bulk of electric light plant, and practically all the electric traction plant, was imported from the United States, and that American manufacturers had gained their trade by supplying machinery to the requirements of the market, and capable of working well under local conditions. In the Commissioner's own words:—"The American electric machinery is looked upon as the most advanced. The English, I am told, have not kept pace with the American improvements and new inventions, whilst the Germans have carefully watched and promptly copied the Americans." German manufacturers are now evidently gaining the reward of their labours at the expense even of American manufacturers.

In all parts of Argentina concessions are continually being granted for electric lighting, power and tramway works, but in this connection it may be well to repeat the warning recently given by the British Consul at Rosario, that great care should be taken by capitalists to ascertain the legality, exact terms, &c., of concessions before making any investments. Amongst some of the works recently undertaken, or proposed to be undertaken, may be mentioned the electric lighting of Rosario, and the electrification of its tramways, the electric lighting of Bahia Blanca and other towns, the extension of the electric tramway systems of Buenos Ayres, the installation of new telegraph lines and the extension of those at present existing. Proposals are also being made for an extensive system of underground railways for Buenos Ayres, and it is

stated that German capital is already interested in this project which promises to be a very important work. The construction of port works at Rosario, which is now being carried out by two amalgamated French firms, although, perhaps, not of direct interest from an electrical point of view, may be cited as a further proof that great developments are being made in the conditions of the country. Recent notices in the Argentine Press state that the Minister of Public Works proposes to ask Congress to sanction the construction of extensive port works at Buenos Ayres, as the present port has become inadequate to cope with the increased trade.

The duty leviable on electrical goods in Argentina is, as a rule, 25 per cent. *ad valorem* with the exception of certain kinds of wire which pay only 5 per cent., certain kinds of shades which pay 40 per cent., and carbons for arc lamps which pay 35 per cent. At the present time a surtax of 2 per cent. *ad valorem* is leviable on all goods paying a duty of 10 per cent. or more, so that in the great majority of cases electrical goods would pay 27 per cent. *ad valorem*. The valuations for duty are fixed from time to time by the Customs authorities. Duties are payable in gold (1 peso gold = 4s.), but national currency is accepted at the rate of 1 peso = 44 cents. Machinery, main pipes, &c., for the public installation of gas or electric lighting are only dutiable at 5 per cent., and in many cases special provision is made that the goods necessary for certain public works shall be admitted duty free.

The following are amongst the chief importers of electrical goods in the larger towns of Argentina:—

Buenos Ayres.—Cia Luz Electrica y Traccion del Rio de la Plata; Cia Sud Americana de Luz y Fuerza; Cia de Alemana Transatlantic; Cia de los Tramways de la Capital; H. Kruger, 386 Florida; Otto Straube, Congallo 1,701; Adolfo Mantels & Co., Belgrano, 602; Juan Quevado, Cangallo, 380; Augusto Parcus, Moreno 477; Juan Carosio y Cia, Sulpacha 433; Le Roy de Bonneville Edmundo, Cangallo 1,268; Walter Kohlstedt, Moreno 487.

Bahia Blanca.—Empresa de Luz Electrica.

Rosario.—Wedekind & Weihmüller, Libertad 754.

Apart from these, there are, of course, the large importing dealers who have their own agents in Europe and who often visit producing markets themselves, and the smaller ones, who order through agents and travellers. In the case of firms having their own buying agents in England, payment is usually made on this side, against shipping documents. For direct trade good travellers or agents are practically indispensable, as the personal element enters very largely into business. In this respect it may be mentioned that in Buenos Ayres a tax of about £4 7s. 6d. per annum is levied on foreign commercial travellers, whilst in other provinces the taxes range from £8 15s. to £147 per annum. The travellers should be well supplied with catalogues printed in Spanish, which is the language of the country, with prices in Argentine currency, and weights and measures in the metric system. Samples and models are also of great value in gaining orders. Samples without commercial value are admitted free of duty; samples of value are charged with duty which is refunded on re-exportation within six months. Advertising of the most elaborate and expensive type is very much in vogue. It is important to note that a contract signed in the United Kingdom cannot be enforced in Argentina, unless it has been viséed at an Argentine Consulate in the United Kingdom.

In conclusion, it may be stated that in a recent report the British Consul at Buenos Ayres wrote as follows:—"The opportunities for the extension of British trade appear to exist in every direction and in every line of business. What is wanted are the people who are willing, and also qualified, to take advantage of the openings."

NEW PATENTS APPLIED FOR.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

13,954A/05. "Improvements in and relating to adjustable electrical resistances." G. Harrison. (Electric Railway Improvement Co., U.S.) (Date applied for under Rule 5 of the Patents Rules, 1905, July 6th, 1905.) February 19th. (Complete.)

4,019. "Improvements applicable to lighting by means of electric arc lamps and to other purposes." F. M. Lewis and H. C. Hughes. February 19th.

4,032. "A portable electric and mechanical signalling apparatus for signalling and giving alarm or call at a distance." J. W. Hintze. February 19th.

4,040. "Improvements in or relating to wires or conductors for electrically-propelled tramcars and other vehicles." W. H. Brocksopp. February 19th.

4,057. "Improvements in contact-breakers for use in connection with electric ignition systems for internal combustion engines." The Electric Ignition Co., Ltd., and F. H. Hall. February 19th.

4,076. "Improved dashpot or checking device for electric meters and the like mechanism." E. Fauvin, E. Amiot and E. Cheneaux. February 19th. (Complete.)

4,081. "Improvements relating to the manufacture of incandescing bodies for electric incandescent lamps." A. Just, F. Hanaman, H. Landesberger, I. Salzmann and the firm Vereinigte Elektricitats Akt.-Ges. February 19th.

4,100. "Improvements in and relating to current collecting devices for electrically-propelled vehicles." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) February 19th.

4,102. "Apparatus for measuring, indicating and registering speed by means of a dynamo in combination with a solenoid provided with a core, whereby the indicator is actuated." W. Mecke. February 19th.

4,151. "Improvements in and relating to pulleys for the trolleys of electric railways, tramways and other purposes." A. Welsh. February 20th.

4,161. "Regulation of alternating-current systems by means of an electric storage battery operated in connection with converters." E. V. Stebbins. February 20th.

4,163. "Improved regulating arrangements for use in connection with electro-mechanical systems for propelling automobiles and the like." H. Pieper. (Date applied for under Patents Act, 1901, February 28th, 1905, being date of application in Belgium.) February 20th. (Complete.)

4,190. "Improvements in and connected with electric switches. B. H. Thorogood. February 20th.

4,220. "Improvements in condensers for wireless telegraphy and other uses." W. W. Massie. February 20th. (Complete.)

4,221. "Improvements in oscillaphones or wave-responsive devices." W. W. Massie. February 20th. (Complete.)

4,229. "Improvements in electrical measuring indicating or relay apparatus." J. Bein. February 20th. (Complete.)

4,236. "Improvements in sparking plugs." J. Aldigier. February 21st.

4,252. "Battery coil and sparking plug testing machine." E. Bristowe and G. Henman. February 21st. (Complete.)

4,272. "Electrical safety lock." G. Hill. February 21st.

4,292. "Improvements in or relating to incandescent electric lamps." H. E. Morris. February 21st.

4,308. "Improvements relating to electrical apparatus for training and elevating heavy guns." Vickers, Sons & Maxim, Ltd., and C. L. Sumpter. February 21st.

4,318. "Improvements in and means or apparatus for driving and controlling electrically-operated capstans, hoists and like hauling and winding apparatus." Clarke, Chapman & Co., Ltd., and H. Walker and G. W. Money. February 21st. (Complete.)

4,322. "Improvements in and relating to electric controllers." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) February 21st.

4,330. "A mechanism to complete a circuit (electric) at any or every hour and minute of the day and night." H. E. Taylor. February 22nd. (Complete.)

4,335. "Improved means for regulating the voltage in electric furnaces." C. Bingham. February 22nd.

4,336. "Improvements in electric furnaces." C. Bingham. February 22nd.

4,343. "An arc lamp." T. L. Carbone. (Date applied for under Patents Act, 1901, February 27th, 1905, being date of application in Germany.) February 22nd. (Complete.)

4,350. "Improvements in and relating to electrical governors for the control of gas engines used for the generation of electricity." H. E. Smith. February 22nd.

4,355. "An improved accumulator grid." J. G. Roy. February 22nd.

4,356. "Improvements in and connected with the propulsion of perambulators, bath chairs and other vehicles by electrical or other motors." W. H. Dunkley. February 22nd.

4,383. "Improvements in electric arc lamps." W. R. Ridings. February 22nd.

4,405. "Improvements in apparatus for electro-plating." S. Weill. February 22nd.

4,459. "Improvements in or relating to the regenerative control of electrically-propelled vehicles." A. Raworth. February 23rd.

4,489. "Improvements in dynamo-electric machines." H. H. Ralston. (Date applied for under Patents Act, 1901, March 1st, 1905, being date of application in United States.) February 23rd. (Complete.)

4,493. "Improvements relating to armature windings for commutating electric machines especially for high-speed machines." The Phœnix Dynamo Manufacturing Co., Ltd., and R. Pohl. February 23rd.

4,510. "Improvements relating to dies for forming accumulator plates." A. J. Blanchon. (Date applied for under Patents Act, 1901, February 24th, 1905, being date of application in France.) February 23rd. (Complete.)

4,513. "Improvements in and relating to electric motor control systems specially applicable to the operating means for bulkhead doors and the like." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) February 23rd.

4,514. "Improvements in systems of motor control." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) February 23rd.

4,517. "Improvements in megaphones and the like." S. E. Parks. February 24th.

4,518. "Improvements in devices for electrically controlling and operating the points of electric railways and tramways." J. B. Opsahl. February 24th.

4,519. "Improvements relating to the electrolytic deposition of copper." H. E. Dolphin. February 24th.

4,528. "Improvements in electrical igniters for internal combustion engines." R. J. Vyner. February 24th.

4,530. "Improvements connected with electric motors, particularly those working cranes, lifts and such like." Veritys, Ltd., and C. B. Walker. February 24th.

4,535. "A new and improved method of and apparatus for detecting electrical oscillations." L. H. Walter. February 24th.

4,538. "Improvements in shade-holders for electric incandescent lamps and the like." T. Torda and C. M. Stanger. February 24th.

4,543. "Improvements in terminals for insulated wires conducting electricity." H. G. Longford. February 24th.

4,565. "Improvements relating to mercury vapour electric lamps." G. T. Fairbrother. February 24th.

4,585. "Improvements in and relating to wireless telephony." H. Wesselius. February 24th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Electrical Measuring Instruments of the Wattmeter Class. Nalder Bros. and Thompson, Ltd., and R. F. Curtis. 5,447. March 15th.

Electro-Magnetic or Eddy Current Brakes and Electro-Magnetic Clutches. D. K. Morris and G. A. Lister. 7,448. April 8th.

Control of Electric Motors. British Thomson-Houston Co., Ltd. (General Electric Co.) 10,017. May 12th.

Vapour-Electric Apparatus. British Thomson-Houston Co., Ltd. (General Electric Co.) 10,215. May 15th.

Fan Ventilators. Crompton & Co., Ltd., and C. Crompton. 10,928. May 25th.

Regulation of the Voltage of Alternating Current Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 11,074. May 26th.

Electric Condensers Particularly for Use in Wireless Telegraphy. R. A. Fessenden. 13,677. July 3rd.

Electric Furnaces. P. Girod. (Date applied for under International Convention, July 4th, 1904.) 13,690. July 3rd.